ELECTRICAL REVIEW

ILLUSTRATED.

A WEEKLY JOURNAL OF

Electric Light, Power, Telephone, Telegraph and Scientific Progress.

VOL. 17, No. 4. WEEKLY. | NEW YORK, SATURDAY, SEPTEMBER 20, 1890. | $3 per annum. Single Copies, 10 Cents.

Copyright, 1890, by Electrical Review Publishing Company, 13 Park Row, New York.

Entered at Post Office, New York, as Mail Matter of the Second Class.

New Work of the United Electric Traction Company.

Our handsome illustration on this page shows an interior view of the power station of the Meriden Horse Railroad Company, at Meriden, Conn. This road is operated by the United Electric Traction Company's overhead system. The dynamos shown to the left are of the usual consequent pole Gramme type, manufactured by this company, and have a capacity of 40,000 watts each. The engines are of the Armington & Sims make, each of 60 horse-power. The boilers are located in the room seen through the door to the left in the background, and are separated from the engine room by heavy brick partitions. This station operates 12 cars on about five miles of track, maximum grade being about 8½ per cent., and the speed about 12 miles per hour.

In Fig. 2 is shown an application of power in the factory of the United Electric Traction Company, at Jersey City, N. J. This factory is operated entirely by electric power, only one room, the assembling room, in which very heavy machinery is operated, is driven directly by the engine, the rest being driven each by a motor or motors worked from the shop circuit. The cut illustrates the winding of the core of a 30 horse-power railway motor armature. The same type of stationary motor noticed above is seen on the floor with its controlling switch on the wall above.

Fig. 3 gives a view of the stationary motor manufactured by the United Electric Traction Company. It will be seen that this machine is of the ordinary two-pole type, having a Gramme armature and a large number of sections, thereby ensuring the greatest steadiness of motion and, by the unusually large size of the armature, operating a powerful torque or starting power. These machines are manufactured in a large number of sizes, ranging from one-half horse-power to 50 horse-power.

The central station plant of alternate current incandescent lighting in Windsor Locks, Conn., is being enlarged and the capacity of the plant will be increased 750 lights, making the total capacity 1,250 lights. The company is operating the Westinghouse alternate system, and the Westinghouse company is now engaged in installing the additional apparatus.

An Enterprising Gas Company.

The Charlestown Gas Company started in the electric light business in 1886. Current was turned on September, 16, 1886, supplying 22 street and one commercial arc lamps. Room used was a very small space in the old gas house, and contained one small engine and dynamo. The company thought then that it would never need any more room or machinery. The new station is of brick, 100x40 feet, one story high, and contains ten 30-light Brush dynamos, and five Armington and Sims engines of 60 horse-power each. The floor is of hard wood. The switchboard, arranged for 10 circuits, is very neat; made of black walnut and ash. The capacity of the new station is 300 full arc lamps. There are now in use 225, of which 100 are street lights. There are also in use 150 series incandescent lamps of 16, 32 and 65 candle-power each, supplied with current by Thomson-Houston distributors off the arc circuits. City lights burn all night, and commercial lights until 11 P. M. The boiler house is of brick, 68x45 feet, 26 feet high, with a truss roof, the trusses being of hard pine, 10x12 inches, with 1¼-inch iron rods running through them. Boiler capacity is 1,000 horse-power at present, using a battery of five boilers of 125 horse-power each. Boilers are of steel, have steel flues, and were made by the Cunningham Boiler Works. They are fed by a No. 6½ Dean pump in the boiler room, and a No. 4 Blake in the cellar of dynamo room. Water used is from an artesian well, 340 feet deep, with a pipe 4½ inches in diameter. The capacity of the well is unlimited. One National heater in boiler room, and one Braman Dow heater in cellar of dynamo room are in use. Boilers are set with Jarvis Engineering Company's setting. Mr. Coyle, the superintendent, believes them to be the very best, because in the old boiler room two boilers had the Jarvis setting and one a plain setting. The plain setting used more fuel than both Jarvis, and although kept at a white heat it could not be held. Fuel used is coke. Smokestack is of brick, 100 feet high, 12 feet square at base, walls are 20 inches for 25 feet, 16 inches for 40 feet, and 12 inches to top. Core of stack is circular, 5 feet in diameter.

Both station and boiler room were designed by Mr. Neal and Mr. Coyle, and were erected under their personal supervision. The location is on Arlington avenue, Charlestown, or Bunker Hill district, Boston.

The officers are as follows:

Jas. F. Hunnewell, president.

Geo. B. Neal, treasurer and manager.

Jas. A. Sawtell, Leonard B. Hathon, Chas. R. Lawrence, Chas. F. Byam, P. J. Stone, W. W. Wheildon, directors.

P. Coyle, superintendent.

Wm. J. Gavin, electrician.

Men employed in station, 4—lineman, 1, with assistant—trimmers, 2.

Delaware, Ohio, celebrated the advent of electric lights with a parade in which the city officials and leading citizens took part.

Fig. 1.—Power Station of the Meriden Horse Railroad Company, at Meriden, Conn., Installed by the United Electric Traction Company.

TELEPHONE MEN IN DETROIT.

GOOD ATTENDANCE OF SKILLED WORKERS IN THIS FIELD.

Several Interesting Papers Read and Fully Discussed—Officers Re-elected.

THE DETROIT COMPANY HANDSOMELY ENTERTAINS THE VISITORS.

There was an unusually good attendance at the Telephone Convention at Detroit, beginning September 9th. The Association met at the Russell House, the meetings being held in the ladies ordinary on the second floor, a very convenient room. Many of the delegates arrived on Monday, and by Tuesday A. M., the hotel was crowded. Several were in the Central Railway collision, and spent a few hours after their arrival in recounting hairbreadth escapes to sympathizing assemblies. None of the telephonists were hurt, however, with the usual luck of the telephone man.

President W. D. Sargent ascended his throne at 11.16 A. M. Tuesday, and pounding on his desk with a copy of the Review, commanded silence. He was greeted with "Good morning, Mr. Reed," which provoked a smile from the genial Sargent, who does not pose as a Czar, but who is a very efficient yet pleasant presiding officer.

The calling of the roll by Secretary C. H. Barney was the first thing, the Mayor of Detroit, who was to have welcomed the delegates in an address, being absent on official business.

The roll call showed 26 active members, three associate and seven honorary members present.

There were about 75 persons in the room at the opening of the Convention, all of whom are engaged in electrical work and represent different companies.

The secretary's report was read, as follows:

SECRETARY'S REPORT.

New York City, Sept. 2d, 1890.

To the National Telephone Exchange Association.

Gentlemen:—I have the honor respectfully to submit my report of this Association for the year ending August 31st, 1890.

At the beginning of the Association year the roll contained the names of 34 active, 6

associate and 27 honorary members. The changes during the year have been as follows:

At the Minneapolis meeting the resignation of the Sunset Telephone and Telegraph Company, of San Francisco, as an active member, and of Clark B. Hotchkiss as an associate member, were both accepted, and the Callender Insulating and Waterproofing Company was dropped from the roll of honorary members, it having gone out of business.

At the same meeting, the Cumberland Telephone and Telegraph Company was re-elected to active membership, and Messrs. Felton and Gilleaume, of Cologne, Germany, were elected as associate members.

Mr. A. G. Day, an honorary member, has died during the year.

These changes leave us with a membership at the close of the Association year, as follows: Active, 34; associate, 6; honorary, 25.

There is now in my hands, to be presented to the Association, the resignation of the City and Suburban Telegraph Association, of Cincinnati, as an active member, and of J. A. Roebling's Sons' Company, of New York City, as an associate member.

The office of the secretary has remained at 510 West 23d street, New York city, during the entire year. The usual number of inquiries for information have been received and replied to, and the *News Letter* has been regularly issued, semi-monthly, until January 1st, 1890, and monthly since that date. The treasurer's report will show that the income of the Association has, during the past year, considerably exceeded its expenses, by reason of a reduction in the latter. There is now in the treasury a balance of $320.99, as against $66.41 at the beginning of the year. All accounts due the Association have been collected, and all debts of the Association have been paid to the end of the fiscal year.

The income of the year was derived as follows:

From annual dues	$1,950 00
From initiation fees	10 00
From sales of extra copies of proceedings	49 15
Total	$2,009 15

The expenses have been distributed as follows:

For salary of secretary	$1,000 00
For printing proceedings Minneapolis meeting	245 25
For other printing, *News Letter*, circulars and blanks	129 40
For office expenses, stationery, postage, telegrams, express and newspaper clippings	98 06
For stenographer at Minneapolis meeting	136 50
For other expenses at Minneapolis meeting	145 36
Total	$1,754 57

Respectfully submitted,

C. H. BARNEY, *Secretary.*

Treasurer Storke read his report, which showed the receipts for the past year to have been $2,009.15; disbursements $1,754.57; cash in hand beginning of year, $66.41. This left a balance in the treasurer's hands of $320.99 a gratifying increase over last year.

The report of the executive committee accepting the resignations mentioned in the secretary's report was read.

All three of these reports were accepted.

Mr. W. A. Jackson, of Detroit, announced a carriage ride for all attending the Convention, at 2 o'clock Wednesday afternoon, and stated there would be other entertainments, for which invitations would be given. Mr. Jackson was applauded as he sat down, and a vote of thanks was tendered him on the motion of the alert Storke, which received unanimous support.

President Sargent then delivered an address from his throne, which received the closest attention. The address is as follows:

The President: Before proceeding to the nomination of officers, I will ask the indulgence of the Association to listen to a few remarks that appear to be pertinent to the occasion of the tenth anniversary of the Association. On the 7th of September, just 10 years ago, the first convention of telephone men assembled at Niagara Falls. The meeting was the result of a circular sent out some time beforehand, signed by representatives of the leading telephone companies in the United States. The object of the Convention, as stated in the circular, was "the formation of a general telephone association to consider the various questions affecting the telephone business and its development." This meeting was organized by the election of George F. Durant as chairman and E. J. Hall, Jr., as secretary. The roll of representatives showed 86 individuals, representing various companies, six representatives of the American Bell Telephone Company and 21 representatives of manufacturing interests. Making a total of 113 individuals. A constitution and by-laws were offered, and various reports and papers were listened to and discussed, after which the Convention, on the morning of September 9th, adjourned *sine die*. Immediately following this adjournment, and on the same day of which this is the anniversary, the first meeting of the National Telephone Exchange Association of the United States assembled. The present constitution and by-laws were adopted, and the following officers elected: President, Geo. L. Phillips; vice-president, H. H. Eldred; secretary, M. F. Tyler; treasurer, D. I. Carson. The Association then adjourned to meet in Chicago, on the first Tuesday in April. The subsequent meetings in Saratoga, Boston, Cincinnati, Philadelphia, etc., are a part of the history of our business.

Of the original members, many have left the business, and a few—but all too many—have been taken away by death, notably our universally esteemed first president, Geo. L. Phillips, and others no less dear, and of whom the Association has expressed its appreciation in just and loving tributes to their merits.

Ten years ago, how rude the business was. The multiple switchboard was a mere idea. Cables were only hinted at. The use of iron or steel wires was almost universal. Insulation was considered of little account by many, and some declared insulators superfluous (laughter). The value of the service was under-rated by the public, and our own standards were far below those of to-day. The highest efficiency and reliability is what the public demand of us, and business and prosperity will follow us just as fast as we are able to meet that demand. The standard of to-day requires the use of copper for conductors, overhead as well as underground, and the substitution of metallic circuits for single grounded wires. The underground wires and cables of five years ago do not answer the requirements of to-day, and the same may be said of central office and subscribers' equipments. With improved service comes increased use by the public, and the ability and energies of the best minds in the business may well be taxed to the utmost to keep up with the demand.

This Association has in the past been active in the development and extension of new ideas and improved methods, and it is, therefore, with regret that I call your attention to the lack of interest and the falling off in membership during the past three or four years. The City and Suburban Telephone and Telegraph Company, of Cincinnati, have resigned, and the active membership is now only 33. The secretary's request for papers to be read at this meeting met with no response. The papers which we have were procured by personal solicitation on the part of the officers. It may be said, indeed, that outside of the secretary's statistical report, the furnishing of papers to serve as topics for discussion during the last few years has been done by a very few individuals. If the Association is to be of service in the future, its members generally must take a more active part in the preparation of the papers and reports which form the basis for our discussions.

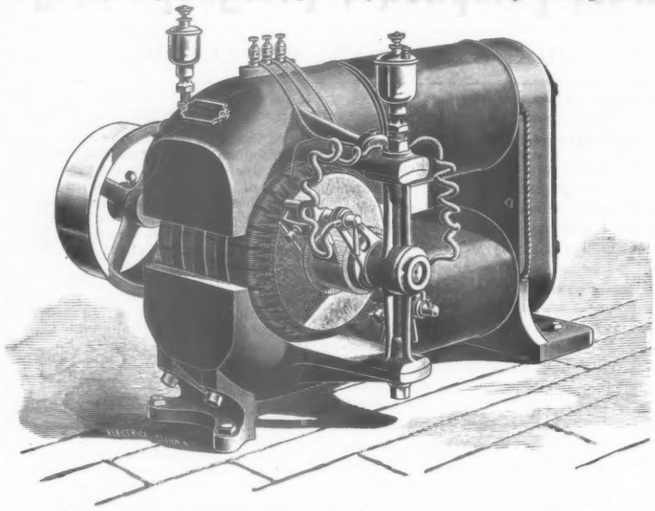


FIG. 3.—UNITED ELECTRIC TRACTION COMPANY'S STATIONARY MOTOR.

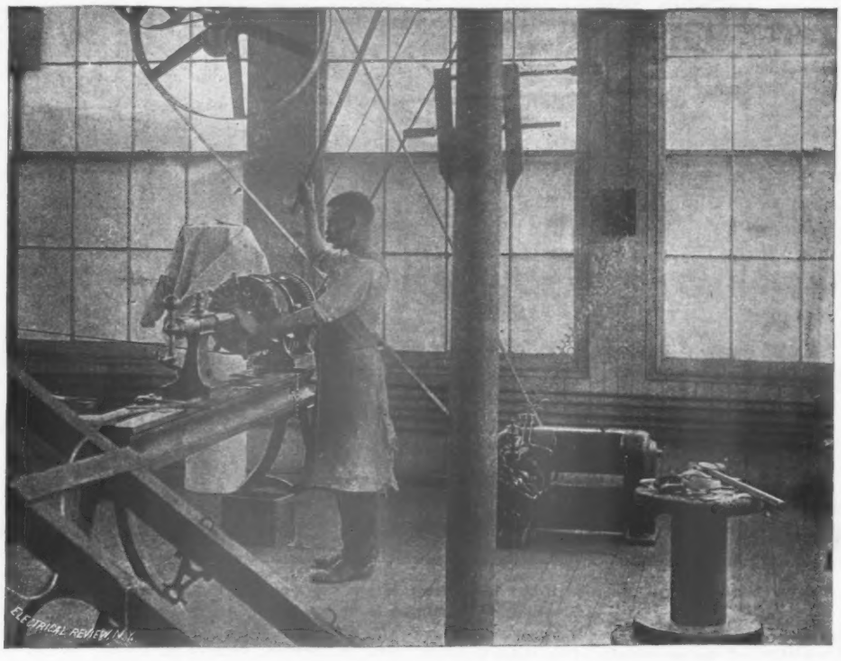


FIG. 2.—VIEW IN FACTORY OF UNITED ELECTRIC TRACTION COMPANY, JERSEY CITY, N. J., SHOWING APPLICATION OF ELECTRIC POWER

In conclusion, I desire to thank the Association for the kindly manner in which they have treated an inexperienced presiding officer (applause).

The election of officers for the ensuing year followed and resulted as follows, after several eloquent nominating speeches had been made by delegates:

President—William Dunlap Sargent, of Brooklyn.

Vice-President—Frank G. Beach, of Chicago.

Treasurer—H. L. Storke, of New York.

Advisory committee—for three years—W. A. Jackson, of Detroit, to fill vacancy (resignation of Geo. N. Stone), A. W. Crandall, of New Orleans; Morris F. Tyler, of New Haven.

Executive committee—Ed. J. Hall, Sr., of Buffalo; Chas. F. Cutler, of New York; H. N. Gifford, of Louisville; C. H. Wilson, of Chicago.

Owing to the absence of the author, the following paper was read, on request of the chairman, by Mr. J. J. Carty:

The Operation of the Double Cord Keyboard at Brooklyn, N. Y.

BY GEO. J. DAVIDSON.

A year ago, I addressed a somewhat extended report regarding the workings of the new multiple switch at Brooklyn, as then operated with the single cord keyboard. On account of the troubles therein shown, and because it was essential that we should be able to operate mixed circuits in the multiple board, it was decided to change the keyboard from the single cord, grounded system, to the double cord metallic. This change was completed early in March, 1890, and the new keyboard has, therefore, now been in use for about six months.

The equipment is full metallic, with tubular clearing out drops, retardation coils, condensers, split telephones, etc.

The change required the connection of answering spring jacks which were placed horizontally in the lower part of the switch, necessitating the moving upward of all the spring jacks originally connected. This movement disarranged the switch cable wiring to some extent, and increased the liability to troubles in that particular, but very little has developed.

The wiring of the line drops had to be entirely renewed, they having been wired originally for grounded circuits only.

The number of troubles as shown by the table herewith is very low, and those occurring were almost entirely of a trivial nature, readily located and easily removed.

In the parts of the apparatus not referred to in the tabulated form, there has been scarcely any trouble. After the change of keyboards had been completed, new transmitter cords were put in, none of which have failed; triple receiver cords were necessarily substituted for the double cords—only one of these has failed.

One of the condensers became short circuited, the result of which was to cause all grounded circuit lines to test "busy" whether in use or not.

The split telephones have been very satisfactory, no trouble whatever having been experienced in their use.

Spring jacks.—We have added 1,720 spring jacks to the 15,660 in use last year, making 17,380 now in use. For the first 13 months' use there were 10 cases of dirty contact; for the past six months there have been 22 cases of this trouble. I think this increased percentage of trouble is due, to a considerable extent, to the disturbance of the switch cables at the time of changing the system, which set free whatever slight accumulations of dust there was in the cables, no small portion of which found lodgment in and about the spring jacks. None of the spring jacks have platinum contacts, the use of which would, I think, lessen this difficulty.

Drops.—1,770 in use, an increase of 110 over last year's report.

The troubles with these have been much fewer than was previously shown, comparing as follows:

	13 Months, 1889.	6 months, 1890.
Catch	26	3
Shutter	36	8
Armature trunnion	203	None
Crossed with core	6	1
Open in coil	2	1
Burned out	1	5
Broken wires	20	8
Total	294	26

None of these troubles require any special comment, the cause and remedy of each being apparent.

Ringing keys.—The ringing keys are of the pattern known as Long Distance Metallic, and there are 273 pairs, or 546 individual keys in use. Only five cases of trouble have developed, four of these being a failure to ring, caused by the generator springs not being properly adjusted, being so far away that the depression of the button did not close the contact between the line and generator springs. The remedy was easy and is obvious.

The other case of trouble was where the button, being depressed, would not return to its normal position. This was due to a slight roughening of the sides of the wedge-shaped rubber plunger where the springs rest against it. A little oil applied at the point of trouble was all that was necessary.

Listening keys.—There are 273 listening keys in use, with which there have been 41 cases of trouble, no one of which, however, was in the main line circuit, or interfered with the subscribers after a correction had been made.

These 41 troubles may be divided into four classes, as follows:

Failing to cut in operator	9
Failing to cut out operator	1
Rubber plunger sticking	27
Rubber pin broken	4
Total	41

Failing to cut in operator.—The nine cases of this trouble occurred in the first 10 months, and on account of the springs not having been properly adjusted when they were connected. The springs rested against the rubber plunger, and did not close the contacts on the operator's circuit. No recurrence of the trouble after properly adjusting the springs by bending them.

Failing to cut out operator.—Only one case of this trouble, caused by the rubber pin of the plunger being so short that the "throw" was not great enough to break the contacts.

Rubber plunger sticking.—This trouble occurred 27 times, and, as in the case of the ringing key, was where the plunger remained down when cam was thrown forward. It was due, to some extent, to a lack of proper smoothness of finish on the wedge-shaped sides. The plunger is pressed upon by two springs on one side and one on the other, the unequal strain having a slight tendency to make it bind. The difficulty was readily overcome by rubbing a little oil on the sides of the "wedge."

Broken rubber pin.—Four of the little rubber pins, which are acted upon directly by the cam, became broken from some unknown cause.

The cams of the listening key make considerable noise when they are thrown forward, but I do not know how this can be avoided.

Tubular clearing out drops.—Two hundred and seventy-three in use, which have required attention 23 times. All of the troubles, except two, were with the catch. The drops are located directly in the rear of and on a level with the cords, the plugs of which in being returned to their normal positions occasionally strike against and bend to some extent the rather slender catch of the drops, which in consequence fails to release the shutter. The remedy for these troubles after their occurrence is obvious. To guard against them the drops should be located elsewhere, which, however, is not practicable in this switch.

The "adjustments" referred to were where the armatures were too loose, requiring the changing of the position of the trunnion binding screws.

Cords.—It appears from the record that only about 35 per cent. of the cords in use had failed during the six months. As a matter of fact, a percentage of failures of the cords *actually used* is much greater. Each of the subscriber operators has 18 pairs of cords available, but habitually used a much smaller number. A half dozen or so pairs of cords being used for the greater portion of the connections, the other pairs in a lesser and lesser degree according to the volume of business.

There were a few failures of the cords at the point of soldering into the shoe, inside of the plug, but the percentage of troubles from this cause is very low.

Almost all of the failures are just at the base of the plug, due to the strain upon the cord in withdrawing the plugs from the spring jacks. The breaking of the tinsels is increased considerably by the perspiration from the operators' hands penetrating the covering of the cords. It is the rule that operators shall withdraw the plugs by taking hold of the same and not by the cord, but it is almost impossible to enforce the rule on long reaches.

The percentage of cord troubles in the double metallic is very much greater than in the single cord, grounded system. In the 18 months' use of 1,200 single cords there were only eight failures, as against 209 failures in six months out of 576 in use in the double metallic. There are two prominent reasons for this increased percentage; first, because as there are two conductors in the metallic circuit cords the liability to trouble is doubled in the same number of cords, and, second, because in the double cord system the use of the cords is so much greater. In the single cord system, a cord is not used except to complete the connections for which the subscriber, of whose line it forms a part, may call, while in the double cord system a pair of cords may be used any number of times, in fact, may be used almost continually.

The one case of trouble "conductors crossed in cord" was caused by abrasion of the insulating material. The effect of such a crossing of the line or test is that any grounded circuit subscriber's line tested with that pair of plugs would show "busy" whether in use or not,

Plugs.—The troubles with the plugs have not been many, amounting to 13 in all out of 576 in use.

Four tips of plugs were broken off in the spring jacks, due, however, more to accident and a lack of care than to faulty construction of the plugs.

The removal of one of these tips from a spring jack is a somewhat difficult matter when it happens to be broken off, when the plug is wholly within the jack, and the tip held fast by the line spring. It is then necessary to relieve the tension of the spring by partially or wholly withdrawing the screw holding it in place and pushing the tip forward until it is within the sleeve of the "test." From this point I find the most convenient plan of removal to be the use of a short piece of flexible rubber tubing; placing one end of the tubing firmly over the opening of the spring, a quick inhalation of breath rarely fails to bring it out.

Tips unscrewed.—The little rivet used to prevent such troubles has come out of nine plug tips, rendering it unsafe to use the plug until repaired.

Referring to last year's report, it will be seen that in the 13 months' record there were 459 cases of trouble with the combination key and 76 with the grounding jacks, total of 535 in the single cord keyboard, or an average of a little over 41 per month. The report herewith for six months shows troubles in the double keyboard as follows: Ringing buttons, 5; listening keys, 41; clearing out drops, 23; a total of 69, or an average of 11½ per month. When it is further considered that about 40 per cent. of the troubles in the single cord keyboard interfered with the subscriber's conversation after the connection had been made, and that not one of the double cord troubles interfered in this way at all, the contrast is very great.

Add to this, too, the great difference in the ease with which repairs may be made to the double cord system, and that the making of such repairs need not interfere with the operator's efficiency nor with any subscriber's line, it seems to me that there can be but one conclusion arrived at.

Discussion was called for and Mr. T. D. Lockwood, of Boston, was the first to speak, complimenting Mr. Davidson and describing the complexity of the modern central office switchboard. He thought remarkable improvement had been made in the work of handling the difficulties of switchboard work.

President Sargent (vice-president Beach in the chair) said the double cord switchboard was much superior to the single cord board.

Mr. J. J. Carty said there was no single cord board adapted to mixed circuits.

Mr. Jasper N. Keller asked if there was a single cord board in use.

Mr. C. H. Wilson said he had two in Chicago. Thought the boards got there in fair style, but preferred the double cord. He alluded at some length to the difficulties caused by dirty contacts in the switchboard; had organized a night force to work on cleaning up contacts, measuring resistances, etc.; still had a good deal of trouble with dirty spring jacks, having about 65,000 in his Chicago offices, and expected to treble that number soon.

Capt. H. N. Gifford thought the Brooklyn office should be congratulated on the successful handling of switchboard contact trouble. Had a great deal of this trouble in his spring jacks—in fact, the largest part of the trouble came from this source. Had made a special cord, with three times as much tinsel as usual, and when a cord broke, a new one was put in, as it did not pay to mend them. Hoped Mr. Barton, of the Western Electric Company, would yet devise a better cord. Mr. Hibbard said the dirty jack trouble was more noticeable in the West, Chicago, for instance, where soft coal is burned. Complimented the Brooklyn office in its cleanliness and excellent location for being kept clean.

Mr. I. H. Farnham said they had avoided noise in working the switchboard at Boston by using flexible contacts. Thought the trouble with spring jack contacts was partly due to corrosion, as well as dirt.

Dr. Culvertson, of Buffalo, submitted some figures relating to his experience with trouble with the Buffalo boards.

Mr. E. M. Barton spoke at some length of the different switchboards, double and single cord, and said the question of contacts in these boards was one that required much careful attention. Said there were a number of single cord switchboards in fairly successful use. But these were not so well adapted for metallic circuits.

Mr. Sargent said that in Brooklyn they did not test through the switchboard with a galvanometer, but kept up a rigid system of looking after the trouble reported from subscribers. In regard to the dirt between the contact of spring jacks, had no doubt different cities would give different results. Favored hard wood floor, which could be kept clear of dust; was opposed to carpets on the exchange floor. Favored the double cord system, thought it essentially the best; particularly in view of the growth of metallic circuits. The single cord board was like a cripple with crutches.

Mr. Wilson didn't want the single cord board to be called a cripple. It had many advantages—only one-half the number of cords being required in the first place. Trouble could be located much quicker. Still he would admit it was not the best board for metallic circuits. Was using a number of the single cord boards in new small private exchanges. These exchanges were for big concerns, like the Illinois Steel Company, which used about 20 telephones, these being connected with the regular exchanges by three trunk lines. A number of these private exchanges were in use in Chicago, and were treated as regular exchanges connected by trunk lines. It was on these that the single cord boards were being used successfully.

On motion of Mr. Hall, the Convention adjourned to 3 P. M.

TUESDAY AFTERNOON SESSION.

Convention was called to order at 3.25, Detroit time, President Sargent in the chair.

On motion of Mr. Eastabrook, Wednesday morning, 10 o'clock, was selected as the hour in which to name the place of next meeting.

As there were three or four different times in Detroit, it was, on motion of Mr. Beach decided to meet hereafter on Detroit local time, which is about half an hour slower than New York time.

The president announced that Mr. Ed. J. Hall, Jr., would read a paper on "Corporate Organizations." Mr. Hall read his paper, which was illustrated by large diagrams on the wall. The paper is as follows:

Corporate Organization.

BY ED. J. HALL, JR.

Corporations have been called "artificial persons," owing their existence to the creative power of the State, and designed by process of law with more or less skill to approximate natural persons in their powers and duties.

When the legislative powers are exercised wisely and skillfully and those artificial persons have been properly constructed, they take their place in society as most useful members, serving the needs of the public in many ways with far greater efficiency and reliability than any natural persons possibly could; for while it may be true that corporations have no souls, it is equally true that they are not subject to paralysis or indigestion.

On the other hand, their design being subject to the fancy of legislative bodies, these artificial persons are sometimes overdeveloped in some directions and lacking in others—the builder who follows the legal specifications often finding that parts essential to some material function are wholly omitted while others are so dwarfed or magnified as to be out of proportion to the symmetry of the intended design.

In the early days of these new members of society, the natural persons then composing it had a feeling of, perhaps, not unnatural alarm that if those artificial persons became too big or numerous they might be troublesome neighbors. What, for instance, if the power which gave them legs and arms should take a notion to add cloven feet, horns and a tail?

This has, from time to time, occasioned the introduction of various restrictions into

(*Continued on page 43.*)

Dayton, Ky.—Dayton Electric Light Company; capital, $25,000.

Lykens, Pa.—Williams Valley Electric Railroad, 10 miles in length, running from the Summit Branch Railroad station, in Lykens, to Tower City, Schuylkill County; capital, $125,000.

St. Louis, Mo.—The Sunset Hill Electric Light, Water and Power Company, with a capital of $100,000. The incorporators are, Marcus Bernheimer, Herman Tuholske and Samuel M. Lederer, trustees, all of St. Louis, Mo.

Chicago, Ill.—San Diego Street Railway Company, offices at Chicago; to construct and operate an electric street railway: capital stock, $250,000; incorporators, Edw. O. Russell, Frank H. Russell and Locke Penfitt.

Chicago, Ill.—Burt's Electric Light, Fuel and Power Company, for the manufacture of arc light and incandescent dynamos, lamps, motors, etc.; capital stock, $5,000,000; incorporators, Jennie L. Bennett, Allen S. Bennett, Martin C. Burt.

Chicago, Ill.—Gillette Electric Gate Company, to manufacture and vend electric gates for drawbridges, railway crossings, etc.; capital stock, $1,000,000; incorporators, Harleigh Gillette, Ernest L. Prussing, Benjamin Stickney, Robert H. Gillette.

Seattle, Wash.—Washington District Telegraph Company; incorporators, A. T. McCargar, E. A. Strout and R. B. Albertson, of Seattle. The object of the corporation is to construct and maintain a district telegraph system, and its capital stock is $30,000.

Seattle, Wash.—The Home Electric Company; capital stock, $500,000. The incorporators are, C. P. Stone, Isaac Dobson, E. C. Kilbourne, D. B. Denton, A. C. Balch and A. Mackintosh. The objects are to engage in the business of electric lighting and furnishing electric power for hire.

Seattle, Wash.—The Pacific Electric Company and the Commercial Electric Company have been consolidated under the name of the Home Electric Company. The incorporators are C. P. Stone, Isaac Dobson, Angus Mackintosh, E. C. Kilbourne, D. B. Denton and A. C. Balch. The capital stock is $500,000.

Orangeburg, S. C.—The Orangeburg Electric Light and Power Company; capital, $3,000. The officers of the company are: President, E. F. Slater; vice-president, O. R. Lowman; secretary and treasurer, Charles Copes; directors, E. F. Slater, O. R. Lowman, A. Lathrop, J. M. Oliver and C. G. Dantzler.

Chicago, Ill.—Chicago & Jefferson Urban Transit Company, Chicago; to build and operate lines of street railway in the city of Chicago and neighboring towns, to be run by electricity or other motive power; capital stock, $1,000,000; incorporators, John Johnson, Jr., Henry Vannetta, Frank H. Dickey, Frank E. Baker, Thomas P. Keefe, Charles B. Hosmer and Edward D. Hosmer.

New York City.—The American Railway Signal Company, with a capital stock of $1,000,000, to operate at Jersey City and New York. Its objects are to operate all kinds of electric railway signals upon railways, and to sell the right to operate and construct the electric signal invented by William W. Rosenfield. The incorporators are, William W. Rosenfield, Anthony Rosenfield, Alexander E. Hoffman and Benjamin Einstein, of New York City.

ELECTRICAL REVIEW

Published at 13 Park Row
P. O. BOX 3329.

GEO. WORTHINGTON, - - Editor.
CHARLES W. PRICE, - Associate Editor.
ROBT. H READ, Manager Patent Bureau.

REGISTERED CABLE ADDRESS:
"ELECTVIEW," NEW YORK.
"1546 CORTLANDT," TELEPHONE CALL.

BOSTON OFFICE:
W. I. BARKER, Room 29, 620 Atlantic Ave.

WASHINGTON OFFICE:
GEO. C. MAYNARD, 1409 New York Ave.

CHICAGO OFFICE:
D. B. DEAN, 61 Metropolitan Block.

EUROPEAN OFFICE:
CHARLES FFRENCH, Bridge House,
181 Queen Victoria St., London, E. C.

SUBSCRIPTION TO THE
ELECTRICAL REVIEW.

One Year, United States and Canada, - $3.00
One Year, Foreign Countries, - - 5.00
Single Copy. - - - - - .10

ANNOUNCEMENT.

Address all communications and make all money orders and checks payable to order of ELECTRICAL REVIEW, P. O. Box 3329, New York.

No attention will be paid to communications for the REVIEW without the *name and address of the writer.*

NEW YORK, SEPT. 20, 1890.

CONTENTS.

	PAGE.
New Work of the United Electric Traction Company	37
An Enterprising Gas Company	37
Telephone Men in Detroit	37
The Operation of the Double Cord Keyboard at Brooklyn, N. Y.	38
Tuesday Afternoon Session	39
Corporate Organization	39
New Corporations	39
A Telephone Entertainment	40
Contracts by Telegraph	40
Submarine Detectives	40
Scientific Reporting	40
Correspondence:	
Our Boston Letter	41
Our Philadelphia Letter	41
Our Seattle Letter	41
Our Chicago Letter	41
Personal	42
Telephonic News	42
A New Curve Insulator	42
An Improved Key	42
Telephonic Ethics	42
New Form of Gas Battery	42
Wednesday.—Closing Session	44
The Housing and Care of Central Office Apparatus	44
Some General Remarks on Telephone Exchange Construction and Equipment	45
"Bridging Bells"	46
The Attendants	46
Telephoniques	46
The Entertainment Provided at Detroit	46
More Strauss Cylinders	46
Recent Electrical Patents	47
Habeas Corpus for Jugigo Denied	47
What's in a Name?	47
The Steel Ship "Seguranca"	47
Telegraphic	47
Deposited Copper Tubes	47
Electric Power	48
Electricity by Tidal Power	48
Mackite Plaster Board	48
British Opinions	48
American Institute of Electrical Engineers	48
A Malleable Iron Break Arm	48
Quicksilver Production	48
Duplex Gas Engines	49
Does Advertising Pay?	49
Electric Light News	49
The Hall Electric Railroad Signal	50
Electricity and Gas	50
Municipal Lighting	50
Frankland's Researches on the Chemistry of Storage Batteries	51
Telegraphic Blunders	51
Kindred Interests	52
Electrical Patents	52

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE.
Ansonia Brass & Copper Co	xxiv
Armington & Sims	xxiv
Bridgeport Brass Co	xxiv
Brush Electric Co	xxiii
Davis, Charles H., Electrical Engineer	xxiv
Day's Kerite Insulated Wires	xxiv
Eastern Electric Cable Co	xxiv
Grant & Co., J. A	ii
Hampson & Co., E. P.	xxiv
Jewell Belting Co	xxiv
Moore, Alfred F	xxiv
Okonite Co	xxiv
Simplex Electrical Co	xxiv
Standard Underground Cable Co	xxiv
Tucker Electrical Construction Co	xxiv
Wilmot & Hobbs Manufacturing Co., The	xxiv

INSIDE PAGES.

American Bell Telephone Co	xx
American Circular Loom Co	xv
American Electrical Works	xiii
Baker & Co	xiii
Ball Electric Light Co	xx
Baxter, H. E. & C	xx
Boston Rubber Shoe Co	vii & xii
Brownlee & Co	xvii
Buckeye Engine Co	viii
Bunnell & Co., J. H	xii
Burton Electric Co	xx
Cary & Moen	xxi
"C. & C." Electric Motor Co	xvi
Central Electric Co	xi
Chadbourne, Hazelton & Co	xviii
Clark Electric Co	xiii
Columbia National Bank	52
Connecticut Motor Co	xviii
Consolidated Electric Storage Co, The	xvii
Crecker-Wheeler Motor Co	x
Dwight Slate Machine Co	xxi
Eddy Electric Manufacturing Co	xvii
Edison General Electric Co.	iv & vii
Edison Manufacturing Co	ix
Electric City Co., The	v
Electric Merchandise Co	vii
Elektron Manufacturing Co	xv
Empire China Works	xx
Empire City Electric Co	xxii
Eugene F. Phillips Electrical Works, Ltd	xiii
Eureka Tempered Copper Co	x
Evans Friction Cone Co	xv
Faraday Carbon Co	xxi
Fort Wayne Electric Co	xxii
Foundry & Machine Department, Harrisburg Car Mfg. Co	xi
Freeman, Walter K	xvii
Garvin Machine Co	viii
Gethins Electric Manufacturing Co., The	xvi
Gibson Gas Fixture Works	xvi
Gordon & Co., W. H	xiii
Great Western Electric Supply Co	xiv
Greeley Co., The E. S	x & xiii
Hall Signal Co	xiv
Hazazer & Stanley	x
Heine Safety Boiler Co., The	xi
Holmes, Booth & Haydens	xv
Holtzer-Cabot Electric Co., The	xx
Illinois Electric Material Co	xvii
Interior Conduit and Insulation Co	viii
Lane & Bodley Co	xxi
Leclanche Battery Co	xiii
Leffel & Co., James	xxi
Lehigh Valley Creosoting Co	xiii
Macfarlane & Co., Wm	52
Maguire, F. Z	52
Manufacturer	52
Marshall, Wm	x
Messmer, C. W	52
National Carbon Co	xvii
National Conduit Mfg. Co	v
National Electric Mfg. Co	ix
Newark Machine Tool Works	xiii
New England Butt Co	viii
New York Belting and Packing Co	xxi
Noyo Mfg. Co., John T	viii
Ostrander & Co., W. R	xiii
Page Belting Co	x
Paillard Non-Magnetic Watch Co	x
Parker-Russell Mining and Manufacturing Co	xxi
Patent Bureau	xv
Phœnix Glass Co	xiii
Phosphor-Bronze Smelting Co., Ltd	viii
Pond Engineering Co	viii
Queen & Co., James W	xiii
Roebling's Sons Co., John A	x
Royce & Mareau	xxi
Santley & Co., W. R	x
Sawyer-Man Electric Co	vii
Schieren & Co., Chas. A	52
Schuyler Electric Co	xviii
Seely & Taylor Manufacturing Co	xiii
Shultz Belting Co	52
Sigourney Tool Co	52
Southern Electrical Supply Co	xv
Stevens & Babcock	x
Thomson-Houston Electric Co	xix
Tropical American Telephone Co	xx
United States Electric Lighting Co	iii
Vincent & Co., Charles R	viii
Wainwright Mfg. Co	xxii
Walker Electric Co	viii
Washburn & Moen Manufacturing Co	xxi
Washington Loan & Trust Co	52
Washington Electric Conduit Co	52
Watson & Stillman	xiii
Western Electric Co	xxi
Western Power Construction Co	xvi
Williams & Potter	viii
Wyckoff Pipe Co	xiii

The difficulties under which an inventor of limited means pursues his calling will be appreciated when it is stated that the model for a piece of apparatus which can be built for $2.00, sometimes costs $900.

New Orleans will be the next meeting place of the National Telephone Association, the time to be announced later. Telephone engineering practice in a city located as New Orleans is, ought to furnish interesting data to telephone men from other parts of the country.

The responsibility for the safety of human lives is in no instance greater or more keenly felt than by those companies dealing in railway supplies. This is especially true in relation to signals governing the right of way on lines over which the passenger traffic is heavy. A company which engages in such a business from a purely mercenary motive and sets up signals which they know to be faulty, is probably answerable to the law under the penal code.

The annual convention of the American Street Railway Association, to be held at Buffalo, N. Y., October 15, 16 and 17, promises to be an important meeting. A great deal of time will be devoted to the electric motor and the details of construction of the electric railway. The Common Council of the city has granted permission to the association to hold an open air exhibition of street railway inventions and supplies. This was proper, as many novelties in details can only be shown in actual practice.

In this issue we give a complete but succinct account of the meeting of the National Telephone Association, held at Detroit during the past week. The papers read before the Convention will be found very interesting. The members were entertained by the Michiganders in royal style, and will remember the City of the Straits with great pleasure.

A TELEPHONE ENTERTAINMENT.

The National Association of Bankers held its annual meeting at Saratoga, N. Y., recently. On the evening of September 4th, 800 members of the Association assembled in the Grand Union Hotel to listen to an entertainment sent over the wires by the Long Distance Telephone Company, of New York. All of the messages were delivered from the Telephone Building, 18 Cortlandt street, N. Y., except the music of the Strauss orchestra, which was transmitted from the Madison Square Garden. The applause at the Garden was distinctly heard in Saratoga, while the telephone people in this city could hear the hand clapping which greeted their efforts in Saratoga.

"The Whistling Coon" was sent over the loud-speaking telephone, the Long Distance Glee Club rendered several choruses, an orchestra performed, cornet solos and recitations were given. The bankers were more than pleased with the entertainment, and expressed the usual amazement at the perfection to which the long distance system had been brought.

CONTRACTS BY TELEGRAPH.

Hugh Coyle, an amusement manager, brought suit recently against the manager of Gilmore's Band for unpaid salary according to a contract between them made by telegraph. At the time the contract was made, it is said that both parties entered into the transactions it embraced in good faith. The receipt of this contract was also acknowledged by telegraph. Judge Giegerich decided the case in the city court on September 11th, and ruled that a contract made by telegraph is not binding and cannot be legally enforced. Such a decision is contrary to precedent, and, if sound, would have a serious effect on mercantile transactions. The appellate courts will not, in all probability, sustain any such decision.

It has been decided frequently that contracts made by telephone are binding, the case of the people against Ferdinand Ward, being an instance of this kind. If such contracts are valid, it is difficult to understand why a telegraphic contract is not legal, provided the good faith of the interested parties can be proved.

SUBMARINE DETECTIVES.

Mr. Herbert Kingsford, the engineer of the Central and South American Telegraph Company, proposes, in a communication to the secretary of the Institution of Electrical Engineers, an ingenious method for obtaining timely warning of the chafing through of the outer armor wires of the shore end of an ocean cable. The shore end of an ocean cable is protected with a double armoring of iron wire, the two armors are separated by a layer of hemp and with this serving Mr. Kingsford proposes to lay up four insulated wires, each equidistant from the other; these wires would extend seawards to the splice between the shore end and intermediate types and the ends would be sealed. At the station on shore the wires would be put to earth through a battery and bell. In this way when the outer armoring was chafed through, one of the alarm wires would quickly follow, and a circuit being established the bell on shore would be rung and notice obtained of the damage before the inner armor wires were attacked. The position of the damage can be ascertained by testing the broken alarm wire and the cable repaired before the core proper is reached, so that no interruption of traffic need take place. This detective system of watching over the condition of shore ends is certainly an ingenious idea. Whatever difficulties might affect its practical success would probably arise from the breaking of the small alarm wires by an uneven strain, or in coiling the cable into lighters when landing the shore end, or else from the development of faults in them not due to the chafing through of the armoring, in which case a false alarm might be given.

SCIENTIFIC REPORTING.

The daily press may not be aware of it, but it is far behind the times. This is preeminently the age of science, and every day the general public is taking a wider and deeper interest in scientific progress and scientific events. The marvelous strides in civilization which have been made during the past 50 years are almost entirely due to the labors of scientific men, and the science which has accomplished the most for mankind is undoubtedly electricity. And yet the utterances of the daily press upon scientific matters, and especially electrical matters, display, as a general rule, the most profound ignorance on the part of the writers, an ignorance so dense and at the same time so ludicrous, because of the infallible tone that most newspaper writers adopt, that the term "newspaper science" has become a by-word amongst technical men.

As a few recent instances of quite recent occurrence we may mention an editorial in a leading New York daily deriding the claims of the phonograph as a practical instrument, whereas, in many offices in this city the phonograph is in hourly use at the present time, and the number is increasing steadily. Another "moulder of public opinion" a few days ago put itself on record as saying that a message received that day from the telegraph ship "Minia," which was in communication with the shore by means of the cable that she was repairing, was the first dispatch ever transmitted from mid-ocean. As a matter of fact, since submarine cables first were laid it has been the custom, and, of course, the very necessary custom, for cable ships to communicate with the shore while laying or repairing cables. Again, another prominent New York daily last week allowed its London correspondent to inform its readers that the meetings of the British Association "have long since lost all scientific interest," and that they have developed into "picnics of professors," whatever that may mean. As our readers well know, the British Association musters at its annual meetings all the eminent men of the various scientific societies which flourish across the water, and among the many papers read a fair proportion are valuable contributions to scientific literature.

Other instances might be quoted almost without number and come to our notice daily. That such slack methods of chronicling the march of scientific events should prevail in our daily press, which at many points is unassailable and inimitable, constitutes a reproach to every newspaper editor throughout the country, and it speaks poorly for the enterprise of the daily press that its utterances on such important subjects should be so wholly without value. There is no reason for this state of affairs, in fact, it would be sound business policy to reverse it completely. There is a very general demand for information on scientific and electrical matters and it would be well worth the while of daily newspapers to cater to it, or at any rate to be sure that what they do supply is substantially correct and not so completely fanciful as it too often is. No newspaper editor would dream of having his sporting news written by a man who knew nothing of racing, trotting, baseball, or the numerous other varieties of sport, nor his financial and commercial columns compiled by men ignorant of the details of finance and commerce, and so on through many branches, such subjects are written up by men who understand them, but any man on the staff is deemed capable of knocking off a column or so of electrical matter at short notice.

The time is fast approaching when a technical editor or at least a technical reporter will have a place on the staff of every newspaper, and the paper that first makes a regular feature of reliable scientific news, written in a popular style, if you like, but still true to facts, will score a distinct advance over its competitors. We are glad to see that certain of the New York papers are leaning in the direction we have just indicated. At least three of the most prominent dailies now publish about once a week a carefully prepared and most interesting column of scientific news. These articles bear distinct evidence of being prepared by trained hands accustomed to such subjects and able to write of them in simple language, and that they are widely appreciated, is plainly apparent from the extracts borrowed from them by papers of every class throughout the country. We hope to see such good work increase and multiply, feeling confident that it will lead in time to the adoption by the daily press of true scientific reporting.

CORRESPONDENCE.

Electrical News from Philadelphia, Boston, Chicago and Seattle.

OUR BOSTON LETTER.

Messrs. J. A. Grant & Company have removed to a handsome suite of offices in the Vulcan Building, No. 8 Oliver street.

Mr. P. A. Dowd has been appointed New England agent of the Wenstrom Dynamo and Motor Company, and has located in comfortable offices at No. 8 Oliver street.

Messrs. David Chalmers and Thos. C. Perkins were among the callers at this office during the present week. Mr. Chalmers represents the Empire City Electric Company, of New York, and Mr. Perkins is the senior member of a young and enterprising Hartford firm.

The Westinghouse Electric Company has received through its Boston office an order from the Milford (N. H.) Electric Light Company for a 750 light alternating machine.

The Consolidated Electric Motor Company, a new corporation which has recently established itself in commodious offices at 95 Milk street, has already met with encouraging success.

An Excellent Showing.—Stockholders of the Tropical American Telephone Company can collect a dividend of 10 per cent. per share October 1, to stock of record September 15. Books will close September 15 to 20. There will probably be dividends also January 1, 1890, and April 1, 1891, as funds are in hand.

Mr. R. T. White, the well-known inventor of the "Daisy Chair" for street railway roadbeds, has appointed Mr. H. H. Mansfield, of New York, as agent for the Middle States. Mr. Mansfield's office is No. 52 Wall street.

Removal.—The New York branch offices of the Tropical American Telephone Company, which were temporarily located at No. 10 Cortlandt street, have been transferred to No. 18 Cortlandt street.

Wrentham, Mass., is soon to be connected with Attleboro, North Attleboro and South Wrentham, by electric railway.

The Kendall Manufacturing Company, Providence, R. I., has purchased from the Westinghouse Electric Company an alternating machine of 150 lights capacity.

The Standard Thermometer Company, Peabody, Mass., is installing an incandescent electric light plant at its factory.

Electric and Gas Consolidation.—The Electric Light and Power Company at Bath, Me., has purchased a controlling interest in the local gas company.

Mr. Fred. P. Barnes, manager of the New England office of the Westinghouse Electric Company, has just returned from Pittsburgh, Pa., where he has been on business.

The New England Wiring and Construction Company has in hand a contract to wire and furnish fittings for 600 incandescent lights in the Master Builders' Building, this city.

The Thomson-Houston Motor Company has been given permission to furnish electric power to exhibitors of light machinery at the coming exhibition of the Mechanics' Charitable Association.

Messrs. J. A. Grant & Company have secured an order for a complete steam plant of 150 horse-power to be installed at Demerara, British Guiana. An engine from the Auburn, N. Y., shops of the McIntosh & Seymour Company will be used in the plant mentioned.

Claflin, Kimball & Company, New England representatives for the Mather Electric Company have secured the contract to illuminate the Mechanics' Fair Building with 1,300 lights. Dynamo capacity of 2,000 lights will be installed, as the exhibitors will want quite a number for their special use. Throughout 16 candle-power lamps will be used.

The Standard Electric Company, of Vermont, has recently sold the following electric light apparatus: The National Needle Company, Springfield, Mass., 300-light plant; Ashley & Bayley, Patterson, N. J., 500-light plant; The Cordis Mills, Milbury, Mass., 300-light plant; and the Republican Press Association, Concord, N. H., 300-light plant. The Standard Company is gradually making a fine reputation for its dynamos.

Dr. Arthur G. Webster, of Worcester, Mass., has been appointed docent in physics at Clark University. He graduated first in his class at Harvard in 1885, and was for one year instructor in mathematics at that institution. His specialty is electricity and magnetism.

The Atlantic Covering Company, Plymouth, Mass., is now prepared to do business with those who have use for a fine grade of covered magnet wire. This company cover wire by a patented process which produces a compact and uniform coating, firm adhesion and excellent insulation.

Citizens' Gas Light Company, of Wakefield, Mass., has been reorganized with several prominent men well known in electrical circles in control. The company placed orders for its electrical and steam plant equipments about three weeks ago, and at this writing the entire apparatus, including dynamos and a powerful McIntosh & Seymour engine, are in position, and everything in readiness to start up on September 16th. W. I. B.

Boston, Sept. 13, 1890.

OUR PHILADELPHIA LETTER.

Personal.—Mr. Sawyer, of the Thackara Manufacturing Company, has just returned from a six weeks' vacation in California looking much refreshed.—Mr. H. T. Paiste, of snap-switch fame, will return from a prolonged European tour on September 24th.

Queen & Company are just now making a number of special instruments for electrical purposes. Their standardized testing instruments are in great demand.

Geo. W. Stone, of Wilmington, Del., was awarded the contract this week for installing an electric light plant in the steamer "Neuse," now being built at the Harlan & Hollingsworth Company's ship yards, Wilmington, for the Wilmington Steamship Company. The plant will consist of 140 incandescent lights and search-light. Thomson-Houston apparatus will be used.

Mr. G. A. Wilbur, Philadelphia agent of the Fort Wayne Electric Company, has recently sold the Front Street Electric Company a 1,000-light alternating dynamo. The new People's Theatre will be lighted by incandescent lights from this station.

The Thomson-Houston Company is now installing an additional 30-light arc machine in the works of the Midvale Steel Company, Nicetown, Philadelphia.

Mr. Edward Davis, Philadelphia representative of the North American Construction Company, with his able assistant, Mr. Fowler, report business increasing as Fall approaches.

W. J. Buck, Sons & Company, 407 North Eighth street, have received the contract for three very handsome electroliers for the windows of Jacob Reed's Sons, Chestnut street.

Clifton Heights, Pa.—The Citizens' Electric Light and Power Company started their plant on the 3d inst. with great display and speech making. The plant is regarded as a very complete one. It cost about $30,000, and consists of two Beck engines, 75 horse-power each, two return tubular boilers of 80 horse-power each, two Thomson-Houston compound dynamos, capable of furnishing 700 lights each, and 15 miles of pole line, extending through Clifton Heights, Burmont, Lansdowne and Darby to Ridley Park, all within a few miles of this city.

The United States Electric Lighting Company, Philadelphia office, recently sold the Standard Steel Castings Company, Thurlow, Pa., a 20-light arc plant. This plant is now being installed under the supervision of Mr. F. Herboth, superintendent of construction, Philadelphia office.

Mr. Edwin F. Baker, general manager of the local electric light companies, Baltimore, was a recent visitor to the Quaker City. Mr. Baker reports the demand for lights unprecedented, he having installed within the past two months 4,000 additional incandescent lights, which brings the capacity of the station up to 1,200 arcs and 10,000 incandescents, of the Westinghouse type.

Mr. L. L. Kingsbury, Baltimore representative of The North American Construction Company, reports business very active. He was a recent visitor to this city.

Mr. Chas. A. Bragg, agent of the Westinghouse Company, recently sold a 10 horse-power motor to drive the hydraulic pump which runs a Stokes & Parrish elevator in the Fire Association Building. The equipment is arranged to pump the pressure tank full of water, when a float device actuates a mechanical contrivance by which the current is cut off from the motor. The device operates the motor automatically, so that the water in the tank is always kept at the proper level, and, at the same time, no current is wasted. Another recent sale made by Mr. Bragg was that of a 20-light United States arc dynamo to the Standard Steel Castings Company, Wilmington, Del.

Alfred F. Moore has secured the two buildings adjoining his wire factory on Third street, and will immediately remodel them to suit his purposes. This addition will about double the capacity of his already large plant.

Chadbourne, Hazelton & Company are considerably behind in their orders for the Wenstrom apparatus. Sales are made by this enterprising firm faster than their Baltimore factory can build the machines.

Tatham & Brothers are engaged on a large cable order for the local Bell Telephone Company. S. L. C.

Philadelphia, Sept. 10, 1890.

OUR SEATTLE LETTER.

The Contract for building the electric railroad on Tacoma avenue for the Tacoma Railway and Motor Company has been let to Robert McIntyre, who has already begun work. The company's extension to the freight house on Twenty-sixth street will be in operation in about two weeks.

The Tacoma and Puyallup Railway, now operated by steam motors, is to put in cars fitted with storage batteries.

Two New Engines, of about 250 horse-power each, have arrived for the electric light plant of the Tacoma Light and Water Company. The additional power will be used in furnishing the incandescent plant, wires for which have already been strung, and in furnishing power for the electric power plant soon to be established.

The Walla Walla Street Car Company is making arrangements for the extension of the line through another residence portion of the city. It has a plan in project to discard horses for electric motors. The company has also a project to construct a motor line to Milton. One of the directors has gone East to obtain the necessary additional capital. The projected motor line will run through a fine fruit and vegetable section, a distance of 12 miles.

An Electric Motor Line will probably be built from Seattle to Edmonds, a distance of 14 miles. The progressive, go-ahead citizens of Edmonds are bound to make a city at that point of no small importance.

On a Sidetrack in the Northern Pacific yards are 24 cars loaded with machinery for the new electric light plant now being built at the foot of Monroe street. This plant will be one of the largest this side of Chicago, and the foundation has already been laid. It is 60x125 feet, walled with stone, with floors of iron laid in concrete filling. One thousand barrels of cement were consumed in its construction. According to the statement of the company, $15,000 have already been expended on the building. The building when complete, will be three stories high, and absolutely fireproof. The machinery provided for the building will be a study in itself. Two separate penstocks, each seven feet in diameter and 500 feet in length, will carry water from above the present dam to the station at the foot of Monroe street. Two flumes take the water through the building and feed six pairs of water wheels. Eight of these wheels have 175 horse-power to the pair, driving 16 Edison dynamos with lighting capacity of 12,000 lights. The other four wheels have a capacity of 375 horse-power, furnishing light to 24 arcs. Any one of the power wheels can be shut off without stopping the others. Of the 12 wheels lying at the station, eight are now being equipped. One feature of the plant is that every piece of machinery is being put in in duplicate. In this way the company insures itself against any interruption of service. The company expects several carloads of materials yet, and will put up lights over Brown's and Cannon's additions. They will furnish 75,000 incandescent lights and 500 arcs. So the materialization of the dreams of the "Wizard of Menlo Park" have come.

H. A. Pevear and Wife, of Lynn, are among the prominent tourists at Tacoma. Mr. Pevear, among other things, is one of the leading spirits of the Thomson Houston Electric Motor Company. Mr. Pevear has made a careful examination of nearly all of the electric railway systems now in operation in the cities visited.

J. C. Todd, of St. Paul, has been in Tacoma several days perfecting contracts for electric railways in this city and at other cities on the Sound. Mr. Todd represents the Thomson-Houston system. He is of the opinion that the proposed electric railway to be built to Puyallup by the Tacoma and Puyallup Street Railway Company, can be operated by two 80 horse-power Corliss engines and four Thomson-Houston dynamos, to be located at a power house to be built near the southern line of the Puyallup Indian Reservation. He has contracted to equip the line and move cars before March 1.

Seattle, Wash., Sept. 11, 1890. H. L.

OUR CHICAGO LETTER.

The Central Electric Company report a growing demand for the patent wire peeler, lately placed on the market. The above company has recently closed a contract for 110,000 pounds of bare copper wire, and 50,000 feet of Candee wire, together with a complete line of supplies for the equipment of a new street railway.

Chas. H. Cone has been appointed Western agent for the celebrated Clark wire.

Those Interested in Electrical School Apparatus will find a choice collection of Ruhmkorff coils, Geissler tubes and accessories, at the Chicago house of the Great Western Electric Supply Company. The coils carried by this company are of several different patterns, complete with reversing switches. There are also carried in stock a number of forms of electric motors for rotating Geissler tubes, and also some for driving models or fans.

The Work on the electric railways in Milwaukee is progressing rapidly, and that city will soon be the possessor of four electric roads.

James F. Kelly, traveling representative of the Edison Machine Company, was a recent visitor in Chicago.

The Illinois Electric Material Company have closed a contract to supply the poles for the Moline, Rock Island and Davenport Electric Railroad. This is one of the largest pole contracts ever closed in the West, calling for upwards of 2,500 poles.

G. A. E. Kohler, Western manager of the Eddy Motor Company, has recently closed a contract for a very large electroplating machine, which will be placed in the new Rand & McNally building. The machine is known as their No. 3.

An Important Meeting of the Chicago Electric Club board of managers was held in the parlors of the Club, on Friday evening, September 12th. The entire programme for the coming Winter was laid out, and will be given in a subsequent issue of the REVIEW.

Chicago proper and South Chicago will soon be connected by an electric street railway.

Two New Electric Roads are contemplated in Kansas City, Kan., and one in Kansas City, Mo.

Geo. Westinghouse, Jr., spent a few days of this week in the city. D. B. D.

Chicago, Sept. 13, 1890.

PERSONAL.

Professor Alexander Graham Bell is spending a few days in Boston.

Mr. Thomas A. Edison is at Schenectady, N. Y., busily engaged in perfecting a new electric railway motor.

Mr. Frank H. Clark, agent for the Thomson-Houston Electric Company in Washington, D. C., is in New York for a few days.

Mr. H. H. Pattee, of Monmouth, well-known to our readers through the lamp-hour recorder invented by him, was in Chicago for a few days last week.

Mr. Ethelbert G. Woodford, of Pretoria, Transvaal, is in the city investigating the newest developments in electricity. He is under the protecting wing of Mr. Milton F. Adams.

Mr. Allen C. Durborow, Jr., business manager of our Chicago contemporary, the *Western Electrician*, has received the Democratic nomination for Congress in the third district.

Mr. McCoubray has resigned his position as secretary and general sales agent of the Crocker-Wheeler Electric Motor Company, and has connected himself with the Okonite Company, with headquarters in New York city.

Mr. Fred. J. Boynton, of Boston, auditor of the New England Telephone Company, has been promoted to traveling auditor of that company through New England. His many friends will be delighted to hear this, as he is very fond of travel and his health will be improved by it.

The many friends of Mr. E. T. Gilliland, one of the most popular inventors in the electrical field in this country, will be happy to learn that he is rapidly regaining his health and now possesses the old time vim and enterprise which characterized him in the past and placed him in the front rank of electrical inventors and manufacturers.

Mr. James Dredge, editor of *Engineering*, of London, accompanied by his partner, Mr. Alexander T. Hollingsworth, and Mr. H. T. Ellicott, a well-known engineer and electrician from Paris, arrived Wednesday on the Teutonic. They dined at the engineers' Club, on Thursday evening, as guests of Mr. William H. Wiley, of this city. These gentlemen are among the early arrivals of the British Iron and Steel Institute, which is coming over to this country in a body late in September, and will hold meetings and participate in excursions as the guests of the American Institute of Mining Engineers. During one of these meetings, Mr. Dredge will deliver the oration at the unveiling of the statue of the eminent engineer, Alexander H. Holly, in Central Park.

Telephonic News

*** Macon and Atlanta, Ga., will be connected by long distance telephone.

*** Wheeling, W. Va., is now connected with Chicago by long distance telephone.

*** The Sunset Telephone Company has completed its lines between Seattle and Pendleton, Wash.

*** The work of building the telephone line from Portland to Salem, Ore., is progressing rapidly.

*** The Commercial Cable Company has declared a quarterly dividend of 1½ per cent., payable October 1.

*** The New Jersey Telephone Company will begin the erection of a new metallic circuit telephone line between Plainfield and Elizabeth, N. J., within two weeks.

*** Arrangements are now complete for the establishment of telephonic communication between London and Paris, and the line is expected to be in operation in a few days.

*** A Wall street rumor is to the effect that Mr. George Gould is to succeed Dr. Norvin Green as president of the Western Union Telegraph Company. Dr. Green's advanced age and Mr. Gould's ambition are assigned as reasons for the rumored change.

*** Stockholders of the Tropical American Telephone Company can collect a dividend of ten per cent. per share October 1st, to stock of record September 15th. Books will close September 15th to 20th. There will, undoubtedly, be dividends also January 1st, 1890, and April 1st, 1891, as funds are in hand.

*** The Chicago law department is getting up an opinion in reference to telephone rates inside the city limits. The department is of the opinion that the city has no power to regulate the charges any more than it has a right to fix the price of gas, and nothing can be done until the legislature grants the city the necessary power in the premises.

*** The Northwestern Telephone Company, of Minneapolis, Minn., will not have its new quarters in readiness for occupancy until September 20th, when the present location in the city hall will be vacated. The extra time consumed in making the changes has been due to the considerable amount of underground work made necessary by the new order of things.

*** The Central New York Telephone and Telegraph Company, of Utica, N. Y., has devised a plan by which the induction to its lines by the electric current on the wires of the Belt Line Street Railroad is in a measure overcome. When the electric cars were first operated, and at times since, patrons of the telephone company have complained of a buzzing sound in the instrument when the receiver was placed to the ear, making it difficult to understand the person at the other end of the line. Trouble was also occasioned in the exchange by the frequent falling of the annunciator when no one had sent in a call. Investigation by the company's electricians revealed the fact that the trouble was occasioned by the electric cars. The current from the underground wires of the railroad spread out and interfered with the return circuit of the telephone company. The difficulty can never be entirely obviated, but a plan has been hit upon by which the service is greatly improved. A large copper wire has been run from the central office between the line wires on which the 'phones are connected, and thence into the ground, thus establishing a balance between the two currents.

A New Curve Insulator.

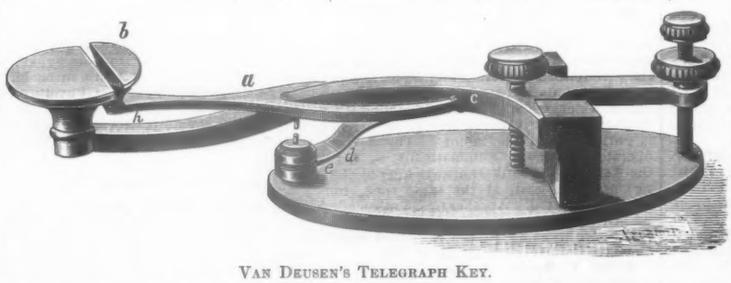
The successful and economical operation of electric railways depends largely upon the proper line construction, *i. e.*, on ample strength of all the parts put under strain, and thorough insulation of the trolley wire from the ground. Owing to the weight of the trolley wire, the supporting devices must be very strong, yet they must insulate the trolley line from the supporting wires. This is the more true at curves, where a strain that is often too much for an ordinary iron pole, is put on the single center curve

A New Curve Insulator.

insulator. It is not surprising that some of the forms now in use have not withstood so severe a test in practice, and have either lost their insulating properties or have partly crumbled up. Such a fate seems impossible for the new form which we illustrate herewith, the "treble" center curve insulator, designed by Mr. Wm. Sharpe for the Great Western Electric Supply Company, Chicago. This is made of iron pieces bolted together and insulated from each other by hard rubber washers and bushings. As the cut shows, the three rubber bushings are in series, giving a treble insulation. A rubber sleeve, fitting snugly over the body of the insulator, keeps this dry, so that the three-fold insulation is obtained in all sorts of weather. The sleeve by enclosing the insulation, also prevents any possible deterioration of the same. The cut does not show this sleeve, but it shows the disposition of the iron and rubber parts, which are made unusually strong and promise to withstand the severest practical tests.

An Improved Key.

In the accompanying engraving we illustrate an improved closed circuit telegraph key recently patented by J. B. Van Deusen, of Saratoga Springs, N. Y. It comprises a key lever *h* provided with a contact adapted to co-operate with a fixed contact mounted on an insulating anvil *e* in the base. The finger piece is split, the front portion *b* being secured to a forked lever *a* pivoted to the lever *h* at *c*. A three prong spring *d* electrically connected with the base bears with its middle tongue normally upon the key lever *h*, and its side tongues bear upon the forked arms of lever *a*, pieces of insulating material preventing electrical contact between the lever *a* and the spring *d*. Under ordinary conditions when the key is at rest the spring *d* raises the forked lever *a* so that the middle tongue of the spring *d* can close the circuit by coming in contact with the key lever *h*. When the operator grasps the key the depression of *b* forces the spring *d* out of contact with the lever *h*, and the circuit is opened and closed at the contact points in the usual manner, by manipulation of the key. When the operator releases the key, the circuit is automatically closed by means of the spring *d* and the circuit preserved in its proper condition for signaling, thus preventing the circuit being left open through the carelessness of the operator.



Van Deusen's Telegraph Key.

Q.—"Which is the best known insulator?"

A.—"Poverty."—*Chatter.*

Telephone Ethics.

A falling-out has occurred between Hugo Brahl, the well-known Nicollet avenue merchant, and the Northwestern Telephone Company and C. P. Wainman, its manager.

Mr. Brahl will immediately sue for $50,000 damages by libel against the telephone company. The following letter from C. P. Wainman to J. H. Weller is the basis of the action:

"We are in receipt of a very insulting letter from Hugo Brahl, because our employés have on one or more occasions refused to give him deadhead service from your instrument. We desire, therefore, to notify you that in the case of Mr. Brahl we shall strictly enforce the condition of the contract which forbids the use of telephones by parties not subscribers. You will, therefore, kindly see that Mr. Brahl is hereafter refused any use of the instrument rented by you. We are always glad and willing to investigate any complaints coming from our subscribers, but when a person undertakes to steal his telephone service and then abuse us because we object, we propose to put a complete stop to his use of instruments."

Some time since, Mr. Brahl had occasion to send a despatch to New York relative to important matters. He went into Mr. Weller's place to telephone the message to the North American Telegraph Company. He says the young lady who presides at "central" kept him waiting several minutes and finally told him the line was busy.

Mr. Brahl promptly kicked. He wrote a letter to the manager of the telephone company, Mr. Wainman, in which he complained of the treatment he had received at the hands of "central." Mr. Wainman replied, and intimated that the company wasn't going out of its way to accommodate people who were not subscribers, and declaring that Mr. Brahl, not being a subscriber, was not in a position to offer any criticism whatsoever on the service. Mr. Wainman also wrote the letter quoted above, which was turned over to Mr. Brahl by Mr. Weller, to whom it was addressed.

Mr. Brahl then addressed another letter to Mr. Wainman demanding a retraction. He explained that hundreds of people were daily doing as he had done, and he couldn't see why they should be called thieves for it, either. He explained that he was willing to pay fully for the service if the company so desired. He insisted that he had good grounds to kick, and gave it out cold unless Mr. Wainman backed water he would fight the company to the bitter end. His position is that he got Mr. Weller's permission to use the telephone, and it was none of the company's business.

Mr. Wainman replied to this. His tone was a little more conciliatory, but he reiterated his former statement that none but subscribers can rightfully use a telephone. He admitted that he thought Mr. Brahl had no wrong intentions, but merely "acted as he did through thoughtlessness."

This was not enough for Mr. Brahl, and there will be music in the air right away. "I propose to make a test case of this," said Mr. Brahl, "and see whether I am a thief or not."

Inasmuch as a great many people are using telephones gratuitously every day, the outcome will be awaited with interest.—*Minneapolis Tribune.*

New Form of Gas Battery.

At one of the meetings of the Royal Society, a short time ago, a new form of gas battery was described by Messrs. Ludwig, Mond and C. Langer. There are several forms of gas battery already known, but the peculiarity of this latest modification is that it is a *dry* gas battery.

The new battery may be thus briefly described: A diaphragm of some porous non-conducting material, such, for example, as plaster of Paris, is saturated with dilute sulphuric acid, or with some other common and suitable electrolyte. This diaphragm is covered on both sides with thin platinum foil, which has been finely punctured, and which contains about 1,500 perforations per square centimeter. The foil is overlaid in its turn by a thin film of platinum black.

The internal resistance is reduced to a minimum by placing the foil in contact at short intervals with strips of some good conductor.

A number of such diaphragms having been prepared in the manner described, they are placed side by side, or one above the other, with non-conducting frames intervening; this arrangement forms chambers through which the gases employed are passed. One side of each diaphragm is exposed to the action of air or hydrogen, whilst the alternate sides are exposed to the action of hydrogen gas, and the spaces which exist between the diaphragm are so connected that the gases pass through the whole series, each in its own proper way.

Experiments were made in order to estimate the electromotive force of such a battery as this, with the result that it (the E. M. F.) was found to vary considerably with the quality of the platinum black.

The best result obtained was:

E. M. F. — 0.97 volt,

and this was yielded when platinum black, prepared as follows, was employed, namely, by precipitation from a boiling solution of platinum tetrachloride by neutralizing with sodium carbonate, and afterwards reducing with boiling solution of sodium formate.

The resistance of a plate of plaster of Paris, 8 mm. in thickness, and having 350 sq. cm. of surface, was found to be

R — 0.02 ohm.

The maximum amount of work was obtained from this battery when the external resistance was nearly double the value of the internal resistance.

After much experiment it was found most convenient to work the battery with an electromotive force of about 0.73 volt, which allows a current of from 2.0 to 2.5 amperes to be taken out of an element with 700 sq. cm. of active service covered with 0.35 gramme of platinum foil and one gramme of platinum black. The temperature should be maintained constant at 40° C. by passing excess of air through the battery.

About one-half of the energy of combustion of the hydrogen gas is converted into electrical energy; this is, comparatively speaking, a high value.

Messrs. Mond and Langer, besides experimenting with oxygen and hydrogen, also tried air and a gas containing from 30 to 40 per cent. of hydrogen—a gas, in fact, such as can be got by the action of steam, with or without air, on coal or coke.

As might be predicted, this battery after having been at work for some time begins to exhibit signs of polarization. In the opinion of Messrs. Mond and Langer, this phenomenon is caused by a change in the concentration of the acid at the two electrodes, and may be remedied by interchanging the gases from time to time; this can be effected with the greatest ease since the materials to be interchanged are gaseous.

It is only fair to remark, in conclusion, that Messrs. C. R. A Wright and C. Thomson have recently stated that the gas battery described by Messrs. Mond and Langer is practically identical in principle with one described by them in 1888 in a paper entitled "On the Development of Voltaic Electricity by Atmospheric Oxidation," and which was perhaps foreshadowed in a previous paper by them, entitled "Note on the Development of Voltaic Electricity by Atmospheric Oxidation."—*London Electrical Review.*

An electric light company has recently been organized in Malaga, Spain. There is nothing particularly original about this, but the originality lies in the name given to the company by its promoters, who have christened it most appropriately the *Fiat Lux*. The name goes very well in Latin, but the "Let There Be Light Company" would not sound any better in English than it would in Spanish.

the specifications, some of them doubtless wise, others unquestionably unwise; but with a realization of the fact that society had not lost, and could not lose, the power to protect itself, has come to a better understanding of the benefits to be derived from properly constructed corporations, and a disposition to formulate the specifications so that their construction shall be encouraged and their capacity for work utilized to the fullest extent by society.

The tone of the press during the recent labor troubles on the New York Central Railroad reflects a marked change in public sentiment from that existing even a few years ago. To some extent, this change is due to a better understanding on the part of corporation managers of the obligations which rest on them, to so organize their forces that the public shall be efficiently served, stockholders receive proper returns, and last, but by no means least, that the employés shall be justly compensated and fairly treated.

To organize and conduct a corporation so as to fully meet all these obligations is no easy task. In my own work I have been greatly helped by making diagrams of any proposed arrangement of forces, for the purpose of studying from that the exact relations which would exist between various departments and employés if the plan were carried into effect.

Almost invariably the study of a diagram brings out unexpected defects of arrangement or suggests changes which would improve the efficiency of the force. President Sargent has asked me to explain this diagram system, and I am glad to comply with his request, because I believe there is for us no more vital problem than the best method of constructing the "artificial persons" who are furnishing the public with its telephone service but for whose actions we are all largely responsible.

I do not see why we should not go at this just as we would at the construction of any piece of mechanism. Surely it is more complicated and more delicate than any of our electrical apparatus, and, at the same time, its motions are attended with such consequences that we cannot afford to make any mistakes.

When we undertake to prepare plans and specifications for the construction of an "artificial person" to conduct the business of a telephone exchange, we must look, first, to the statutes of the State, in which we will find the legal specifications. From them are prepared the charter, articles of incorporation, which, in a general way, define the nature of the proposed corporation and the position which it desires to occupy in relation to the State, while the by-laws, which are to some extent controlled by statute, provide, generally, for the relations of the corporation with its stockholders.

By the articles of incorporation and the by-laws, provision is made for the control of the corporation by trustees or directors elected by the stockholders, and by certain officers, usually a president, secretary and treasurer, elected either by the stockholders or by the directors. These officers are common to all corporations, and are charged with certain duties by the State and by the by-laws.

It would be interesting to go more fully into the relations thus established between the new corporation, the State which gives it being and the stockholders who risk their fortunes on its success. We will not, however, stop to do so now, because we are considering to-day only the executive forces, the *physical structure* of our "artificial persons." The functions of the officers named will be considered only as they relate to the performance of the work for which the forces are to be organized.

The unit of work, that is, the amount which can be performed by one person, is very small, so we must subdivide until each part of our work receives its proper share of attention; but, as all of the parts are interrelated, it is evident that there must be somewhere a single central authority, for the division means chaos. From this central authority there must be a direct line of communication to every department and every employé; no matter how many department chief and through him to his subordinate officers, superintendents, managers, foremen and so on, until it reaches the last messenger boy.

The general office is particularly the department of the general manager Its work consists: *First*, in receiving and recording the orders of the president and directors and transmitting them to the proper persons for execution. With the orders must go the funds and materials for carrying them into effect and the details of the method to be followed. *Second*, to the general office must come back the reports and results of all work, which must be recorded and transmitted in proper shape to the directors. *Third*, through the general office all arrangements must be made for *transfers* from one department to another.

The general manager acts as the connecting link between the authority which shapes the plans and controls the policy of the company and forces which carry those plans into effect. He should be identified as closely as possible with both, and this is often accomplished by making him a member of the board of directors, thus enabling him to fully understand the nature of the results to be accomplished, while at the same time, his close relations with the working forces enable him to keep the directors fully informed as to the condition of the company's plant and forces, their possibilities and needs for accomplishment of any desired result.

The general manager, as the diagram shows, has no authority over the secretary, treasurer, auditor or any employé on the president's line, but such relations as are necessary must be established by order of the directors or president, unless, as is often the case, the general manager is also vice-president, in which case his relations are established by the *latter position*.

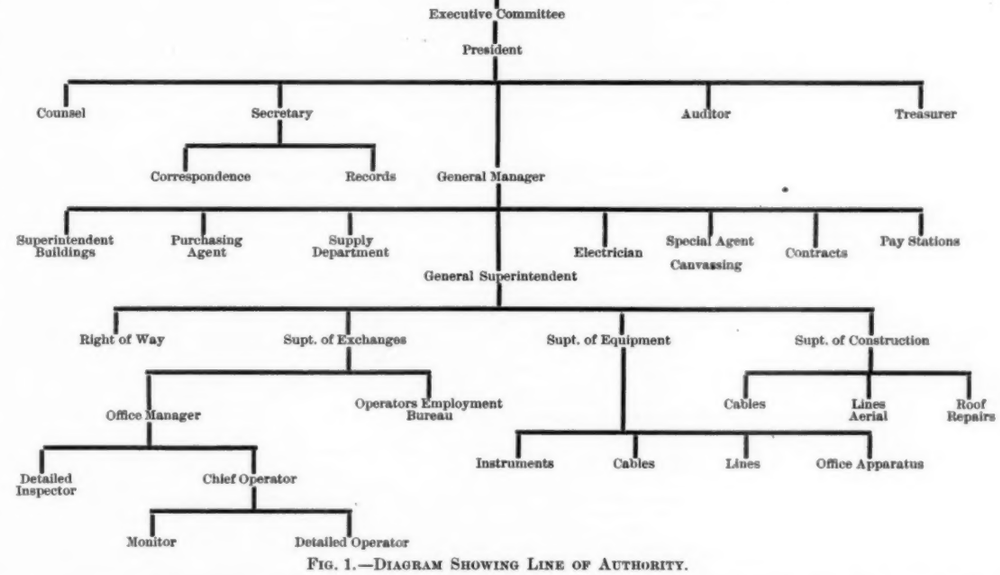


FIG. 1.—DIAGRAM SHOWING LINE OF AUTHORITY.

This distinction is important, and it applies equally in the case of all relations between officers and employés of different grades when one person fills two offices not in the same "line of authority."

The general manager should be responsible for the appointment of all employés on his staff or below it, but it does not by any means follow that he should in person select all individuals for appointment; on the contrary, holding a veto power over all, he should select none but his personal assistants and the heads of the departments, for the same reason which makes it necessary for him to control all appointments, makes it necessary that—following the line of authority and, conversely, of responsibility—each other officer should, so far as possible, hire and discharge all for whose efficiency he is immediately responsible.

Just here I want to point out the error into which all of us who have charge of a number of men are apt to fall. That is, of doing too much detail work, to much *work* I was about to say, but it is the quality not the quantity generally at fault. It is often so much easier to do personally than it is to teach others, that we fall insensibly into the error of doing routine work which others can do as well or better; and having filled our day with arduous labor, go home at night tired but satisfied that the day has been well spent, when, as a matter of fact, we have perhaps lost sight of our duty to keep track of and direct the work of others and have performed the work of a junior clerk while the interests committed to our charge have suffered in all directions from neglect.

The functions of the construction and operating departments, with their various subdivisions, are so well understood by all that it is unnecessary to go into details, and we will follow quickly along the line of authority, through the office of the general superintendent to the linemen on one side, and on the other to the operator and messengers.

Now, to pass on one point of the diagram to another, we must follow back and around on the established lines. There must be no cross lines of authority established or immediately there is a division of responsibility. This does not mean that there are to be no direct relations between officers and departments except over the route of lines of authority. On the contrary, as I have already said, there must be almost innumerable "lines of relation." These lines may be established in two ways. First, by order of some common superior authority, and second, by an understanding between the employés concerned.

For instance, by order of the president, the treasurer might be authorized to use office managers to collect certain accounts or pay certain bills. The treasurer would then have a line of direct relation established with each office manager, but the authority would originate with the president, and his order would pass through the hands of the general manager, general superintendent and superintendent of exchanges, to the office managers. Authority given to the treasurer to employ the managers would always be given with the tacit or expressed understanding that the regular duties of the employé called on should not be interfered with, and that the employé's first duty was, in every case, to his immediate superior.

As an instance of the second sort, it might be arranged between the construction department and the equipment department that one could do certain things in connection with the other's work; for example, that the equipment department would hang a cable which the construction department was responsible for hanging. The test of this transaction would come in case of failure to carry out this understanding. Would it be any excuse for the superintendent of construction to say that the superintendent of equipment had promised to hang the cable, and had failed to do it? Clearly not. The diagram shows how such an arrangement could have been made by authority. He took the chances of an arrangement under which he had no control over the other party, and he accepted all the responsibility.

In a bad organization this constant shifting of responsibility is always found, and the blame should be with the organizers rather than with the employés, who are probably doing the best they can with the faulty system.

Another fault, always found in a bad organization, is a defective method of giving orders. Sometimes an organization that otherwise would be good is demoralized in its work by a careless habit of giving vague verbal orders, a practice sure to result in confusion.

Whenever practicable, orders should be given in writing; they should be brief and clear, and whatever is to be left to the discretion of a person carrying out an order should, if possible, be so stated. Advice and suggestions may be verbal, and often are better so. When an order is accompanied by advice or suggestions as to methods, care should be taken to so separate the order and the suggestions that there may be no misunderstanding.

When verbal orders of any importance are received by any employé, he should take the earliest opportunity to reduce them to writing, and send an acknowledgment of them, explaining his understanding of their nature, to the officer from whom they were received.

The chart which I have made shows substantially the general organization of a large company, but one which operates a comparatively small territory. Of course, a chart prepared for one telephone company or exchange would not be suitable for all others, or, perhaps, for any other; but there are certain functions which are common to all, and modifications can easily be made to fit all conditions.

The keynote of all successful organizations is sounded in the Bible words: "No man can serve two masters." In the abstract we doubtless all agree with this, but in practice we often make discord instead of harmony among the delicate strings which bind our forces together. It is easy to say that we all arrange our forces so that no man shall serve two masters, but it is far from easy to do it. Especially is it difficult in a small company where the number of men must necessarily be limited, but where the manifold duties of the service must still all be performed. Even in the larger organizations, it is far easier to cross and tangle the lines than it is to keep them straight. The diagram system will aid the manager of a small company to arrange his men to advantage, while to the manager of a large company it will act like the "deadly parallel column" in the newspaper, pointing out all inconsistencies between theory and practice.

Our work of organization and administration is, under the most favorable conditions, perplexing and difficult. Lines must be built, offices equipped, apparatus designed and constructed, records kept, rights of way obtained, reports made, supplies purchased and taken care of, problems, legal, financial, scientific and practical, solved, and with all we must reckon with human nature in all its varied forms. Each unit of the vast aggregation must be placed where it will be most beneficial to the whole, and yet each be so dealt with that personal pride and self-interest shall be considered, faithful service and capacity duly rewarded, the ignorant educated, the idle punished, the vicious and incapable eliminated, and over all strict dis-

cipline, tempered with sympathy and kindness, maintained. Only a thorough organization, wisely administered, can accomplish all this. Without organization the ablest will fail and with it the best will often fall far short of their ideal.

When we have constructed our "artificial person" from drawings which clearly show the location and relations of all the parts, and from specifications which define in exact language the functions of each, it may still lack much of the perfection of the natural person, but I am sure it will do its work with far more efficiency and vastly less disturbance, than if it be simply an aggregation of unrelated parts tangled together by the old-fashioned "rule of thumb" method.

On motion of Mr. Eastabrook, Mr. Hall's paper was accepted with thanks.

Mr. J. J. Carty then explained the diagram shown in Fig. 2, which applied to the work of the Metropolitan Telephone and Telegraph Company, of New York. He stated that while the scheme was not entirely complete, it had been of the greatest assistance and when thoroughly planned out would be invaluable for thorough work.

Mr. Barton asked concerning the authority of chief operator and chief wireman.

Mr. Carty said there was no line of authority from one to the other, only one of relationship. The chief operator looks after the operators, the wire chief attends to the apparatus.

Mr. Hall explained that the office manager would have authority to look after this office, but the condition of the plant would rest on the superintendent of equipment.

Capt. Gifford asked if the superintendent of equipment had charge of the construction work.

Mr. Hall said that the duties of each should be clearly defined in writing. The duties could be delegated as seemed best. This method was not one of red tape, but one of simplification. He illustrated very clearly the working of the system by taking an order for a new telephone subscriber and illustrating clear through until the subscriber is getting service and everything recorded in the proper place.

Mr. Eastabrook asked about toll rates, with special reference to the long distance work. He desired to know whether the general manager should fix rates.

Mr. Hall thought this would fall within the province of the general manager, but that would be a matter of arrangement.

Mr. Tyler thought none of the general managers of the local companies would have much to say about the rates of the American Telephone and Telegraph Company. (Laughter.)

Mr. Lockwood thought the ideas presented by Mr. Hall of great value.

On motion, adjourned to meet on Wednesday at 10 A. M.

WEDNESDAY.—CLOSING SESSION.

The Convention was called to order by President Sargent, who used an induction coil of a fiery red color as a gavel. The hour was 10.15 A. M., by local Detroit time. The selection of the place of the next meeting was announced as the special order.

Mr. A. W. Crandall, of New Orleans, named his city as the place, mentioning a number of inducements which he knew would attract all the members, old and young.

Mr. Edward J. Hall, Sr., said the invitation to go to Buffalo was still good, and the telephone men would be warmly welcomed in that city.

The president stated he had a billet from the proprietor of a hotel at Cape May, inviting the Association to meet there.

On motion of Mr. Eastabrook, New Orleans was selected as the next place of meeting, the executive committee to decide on the date.

A paper by Mr. W. R. Patterson, of Chicago, was then read by the author, as follows:

The Housing and Care of Central Office Apparatus.

BY W. R. PATTERSON.

The cost of the apparatus in a large central office is often greater than the cost of the building which contains it; at the least, it is equal to a very considerable fraction of the cost of the building.

In renting an operating room for a short term, there may be some excuse for taking things as they are found and working the exchange at a disadvantage in some particulars; but when a special building is to be erected, nominally as a telephone exchange building, it must be something more than an office building with the most undesirable part grudgingly spared for an operating room. An outside income from rental of offices and stores is a good thing, unless it is secured at the expense of the legitimate business of the company. The switching apparatus of an exchange system is not a lot of separate instruments, like the outfit of a telegraph office, but it is a complex entity which requires weeks or months to put in position and the parts of which are not easily renewable or accessible. Therefore, in planning the construction of a building, the fact must not be lost sight of that it is a Telephone Building, and that its purpose is to protect the central office apparatus and facilitate economical and satisfactory service.

In planning a new building, the company's electrician is to be consulted before the architect. The electrician's duty is to plan a switchboard room with reference to the best possible arrangement of the board and all the apparatus connected therewith, having as the only limitation the size and shape of the building lot. The process of evolution of the building must be, first, the switchboard with its accessories; second, the finished rooms to contain them; third, the building of which these rooms form a part. At the third stage, and not till then, except as a consulting engineer, should the architect be called in. Give him the building lot and the finished operating room and its complete equipment as his limitations, and then let him do the best he can with the building.

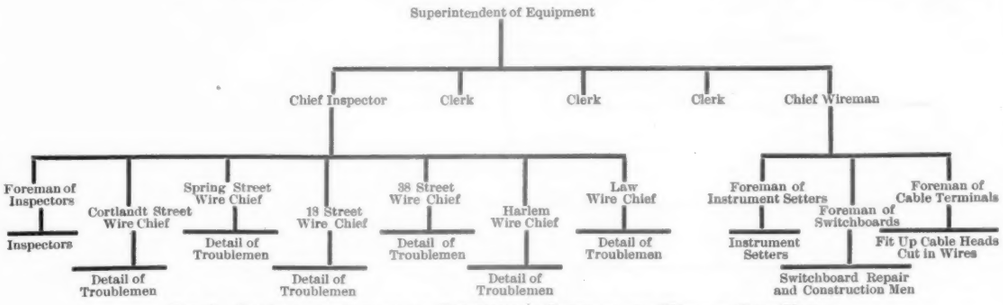


FIG. 2.—DIAGRAM AS APPLIED BY ELECTRICIAN CARTY TO HIS WORK IN NEW YORK.

As to the location of the operating room in the building, precedent is the top floor. When all the wires were on poles and housetops, the most convenient place for the switchboard was at the top of the building. The use of underground wires is almost universal, at least for leading in from neighboring poles, and this would suggest that a more advantageous place might be found in the lower part of the building. It is impracticable to lay down any hard and fast law, but it would seem that the use of the first or second floor for an operating room was worth considering. Financially, the problem is whether the rental value of the top story plus the rental value of the space occupied in each story by the cables leading in, plus the interest and depreciation on such cables, is greater or less than the rental value of the first or second floor. In case of a building covering an entire lot, the advantages of an operating room on a lower floor are not so obvious, but in a large building where an interior or rear court is left for light, the operating room may economically be placed on the second floor; building up the court two stories instead of one and using the rear of the basement and first floors for storage, so that, for example, the room taken for the exchange room would be in the rear of the second story as against the whole of the top story. Of course, this is only an illustration of what might be done in one case.

Electrically, everything is in favor of an operating room near the ground when, as is the general practice, underground cables are used. One or two hundred feet of cable made a permanent part of every circuit, is in itself of no importance; but in large cities the amount of cable absolutely required elsewhere and the possibilites of long distance work with connections into and through other cities, make it important to cut the amount of cable down to what must be used.

All these things, and many others which local conditions impose, being considered and the operating room planned and its position in the building determined, the next points for consideration are: Getting the switchboard and other apparatus into the room, connecting the switchboard with the underground conduits, heating, lighting, and ventilating the operating room and protecting it and its contents from fire.

Providing means for getting in and out with apparatus must be considered. In making plans, the best way is to project into space the switchboard, then project around it an operating room, and then fill in the rest with the best arrangement of rooms and offices. But in building, the process must be reversed—first, the building, then finish the operating room, and last of all put in its furniture.

Dragging switchboard sections into an unfinished building through a window or a hole left in the wall is poor policy. While the ultimate end of any machine is the junk shop, a piece of work like a switchboard makes more progress towards that end in a few weeks in an unfinished building than in years of service.

Provision must be made for getting cables from the street conduit to the switchboard. The position of the building relative to the conduit, and the number of cables to be accommodated, will determine the best way of getting from the conduit into the building. In general, a tunnel accessible throughout its whole length is best. If the cables are to be taken up through the building to an operating room on the top floor, there are several ways of getting them there. One is through ducts built in the wall; another through pipes fastened to the walls, either inside or outside; another is through a shaft or well-hole in which the cables are accessible. Whichever plan is adopted, it should be carried out in such a way that cables of as good specifications as the regular underground cables can be used. In general, the shaft is the best plan, then the pipes on the walls, and least satisfactory the system of small flues in the walls. The shaft is of advantage not only in handling cables, but also as a ventilator for the conduit. A good plan for a large exchange, to require a hundred or more cables, is a straight tunnel or passageway through the building from the conduit in the street to a point under the cable terminal room. From the inner end of this tunnel a straight shaft to be carried through the roof with provision made for clamping the cables upon the sides at short distances, and with a stairway or an elevator in the center; the cables to run continuously from the street to a terminal room adjacent to and practically a part of the switchboard room. If the operating room is on the lower floor, the large shaft through the roof will be unnecessary, provision being made for a shaft or flue large enough to ventilate the conduit, either by natural draft or by a fan.

Now, as to the construction of the operating room itself with reference to lighting, heating, ventilating and fireproofing. First let us consider the contents of the room. The apparatus therein forms a part of every circuit and every conversation passes through it. The time is rapidly approaching when all the circuits will be metallic—that is, a circuit will be no longer a single wire, but two sides which must be balanced within a very small limit—balanced not only in resistance, but in capacity and insulation. Then, there are, in spring jacks and keys, contact points numbering in the aggregate into the hundreds of thousands, poor contact in any one of which will cause poor service on some line. The surface on which the springs and contacts are mounted, and to a greater or less extent the insulating material of the thousands of miles of wire used in connections, are hygroscopic, and the insulation of this part of the circuit rapidly falls with the increase of moisture in suspension in the air. A particle of dust under a contact spring either opens the line entirely, or throws in more resistance than the whole circuit should have. The extension of underground telephone circuits, the increase of electric light and motor lines, and the continued demand for better service, all require that better work shall be done in the switchboard room than was even suggested a few years ago. This being the case, more thought must be given in the future to the heating, ventilating and care of such a room than they have received in the past. Instead of letting this matter rest and provision be made for heating as a sort of after thought after the building is planned, and no provision made for ventilating except by open windows and doors, it must be one of the first to receive attention. The heating and ventilating of the operating room must be planned together. Windows and doors, as a means of ventilation, must be ignored and windows only used for light. Heating should be by a system of indirect radiation, and the air must be at all seasons of the year of uniform dryness and freed from dust. The coils for heating the air in the Winter may be used for cooling it in the Summer, circulating cold water or a freezing mixture through them instead of steam. The electrical and mechanical engineer must furnish the detailed plans and specifications for this work and the architect must accept them, together with the switchboard room and cable conduit, as the things around which the building is to be erected.

When windows are used for ventilation, good service cannot be expected. In a city where soft coal is burned, the soot is a cause of high resistance if deposited on the contacts, and making contacts of platinum will not remove it because the separation of the surface is a mechanical one and is not due to surface corrosion. This soot is much worse than street dust since it is adhesive, and the continued closing of contact springs tamps it down on the surface so that only a file or scraper will remove it; on account of its adhesiveness, putting contacts vertically will not cure all the trouble, for the reason that the particles of soot will not fall off. Smoke from bard coal is less objectionable, but even this causes corrosion of contact surfaces and renders the use of platinum necessary. Apart from these electrical difficulties caused by dust, its presence, more especially gritty street dust, in the room, causes the rapid wear of cams, plungers and other parts of the apparatus which require to have a motion which can be affected by friction. A switchboard set so that a draft of smoky or dusty air passes through will arrest a great part of the ponderable particles. The prinoiple of dust arresters used in pipes from saw mills, grinding rooms and the like, is that the current of dust-laden air has its direction suddenly changed. The inertia of the particles preventing them from changing their direction promptly, they are left, while the air pursues a tortuous course and escapes. The springs and wires act in just this way on a current of air driven through the board. Enclosing the back of the board is good as far as it goes, but it is not enough. It is much easier to keep dirt out of the room than to keep it out of the board when freely admitted into the room.

In cities exposed to frequent fogs, especially along the coast, the insulation of the apparatus will run very low at times, and the deposition of salt on the surfaces makes them more hygroscopic and tends to increase the escape. The only insulating material suitable for most of the switchboard work is vulcanite or hard rubber. This is a vulcanized compound and a continual moistening and drying of its surface results in the oxidation of sulphur to form sulphuric acid. Both these causes result in a permanent lowering of the insulation.

The regulation of the amount of moisture in the air, and its removal above hurtful limit, has also a direct bearing on the fireproofing of the board. Of necessity, a great mass of insulated wires must be used to connect key tables and jacks. The spring jack connections can to a great extent be cabled, and by this means made less inflammable, but the keyboards must be wired with loose wires. There is no insulating material available, so that it is both moisture proof and fireproof. Fireproof qualities are generally made secondary to waterproof qualities, and so the under and back sides of the boards are covered with an inflammable mass of paraffine, beeswax or rubber covered wire. If hurtful amounts of moisture can be kept out of the room the problem of fireproofing is solved, because dry cotton or silk can be used for the insulation of the wires. A wire closely covered with dry cotton is as near fireproof as it can be made, and the only objection to be brought against its use is its hygroscopic nature and the consequent

low insulation resulting from moisture absorbed from the air.

Precautions having thus been taken to prevent the ingress of dust and moisture with the air, the room should also be constructed with reference to its care and with a view to reducing to a minimum the production of dust and dirt within the room. A tile floor, or, at least, one of well-finished hard wood will assist in this, and the janitor must have learned his trade in a picture gallery rather than on a canal boat. Battery and repair rooms must be entirely disconnected from the switchboard and cable rooms and the operators coming in from muddy streets should not go into the switchboard room to reach their dressing room. Dust collecting and producing carpets, rugs and hangings must be omitted from the furniture, and it may be that some time the operators will be required to dress in the least dust and lint producing fabrics. Before that time, however, the manufacturers will be expected to produce a cord that will not fray out and add its contribution to the dust.

It may seem that too much importance has been attached to such little things as a regulation of moisture to within a small percentage and removing dust. But all the precautions advised are no more insignificant than have to be observed in some branches of manufacture, notably the spinning of fine cotton. The telephone itself is made up of little things. The little things in connection with circuit construction, cable work, strong current protectors and line tests, have been worked out to a greater or less extent, and no step has been so small as not to show an improvement in the result. The next advance is to be in the proper care of the switching apparatus and in the construction of exchange buildings, mainly with a view to the protection of the apparatus.

Now, having decided upon the position of the room in the building, your electrical engineer having laid out the floor plan of board and cable room, your heating engineer having provided ducts and rooms for admitting and treating the air, you are ready for the architect. You will have projected into space the room devoted to exchange work, and the connection of these rooms with the street conduits, and the complete heating and ventilating plant attached. This is turned over to the architect. He may not be able with these limitations to introduce all the artistic features he would desire in the front, he may not be able to plan such desirable suites of offices as he would if left to his own devices, he may not be able to plan stores more desirable to tenants than anything else in the neighborhood; but you will have an exchange room which is not an afterthought and which is not the leavings of everything else. In such a room the life of the apparatus will be prolonged, and if originally well constructed, it can be depended upon to give uniformly good service.

There may be exchanges working under exceptionally favorable conditions of climate and surroundings where all these precautions would seem unnecessary, but none of them are very expensive and none of them could do any harm.

In existing buildings, where the record of troubles shows a preponderance of open contacts, and where frequent cleaning of contact points is found necessary, it would undoubtedly pay to introduce the heating and ventilating plan above recommended. An indirect radiation system of heating is fully as cheap as any other, the only additional expense being the running of the apparatus for ventilation when artificial heat is not required. This expense would not be worth considering if all trouble from open and high resistance contacts could be avoided. That it can be, there is no reason to doubt. If the dirt is kept out of the room it cannot get into the board; if moisture is kept out of the room it cannot get into the insulation of the wires. Dirt can be kept out of the room and the degree of moisture regulated just as well in a switchboard room as in a theatre, library or spinning room.

Mr. F. A. Pickernell, of New York, followed with his paper:

Some General Remarks on Telephone Exchange Construction and Equipment.

BY F. A. PICKERNELL.

The modern telephone exchange building should be thoroughly fireproof.

False floors and concealed masses of wire should be avoided; for a fire once started in such places is extinguished with great difficulty.

In its erection everything should be sacrificed that in any way interferes with the particular object for which it is built.

In the basement, racks are to be provided for underground cables.

Between the basement and the terminal room, a cable shaft or system of ducts is to be constructed.

On the top floor are to be located the operating, terminal, battery and power, cloak and lunch rooms. These rooms should be provided with chemical fire extinguishers, and the manager, wire chief and assistants, thoroughly instructed in their use.

In the case of fire, every effort should be made to suppress it without calling on the fire department. If the fire should attain considerable proportions, it could, at its worst, only consume all the combustible matter in the room, for, inasmuch, as the operating room is on the top floor, the fire could not cripple any of the supporting columns or beams of the building and cause it to fall.

If a small fire was started and the average fireman admitted, he would do more damage with his axe and hose than the fire would in entirely consuming the apparatus.

Before a telephone company is in a position to erect a suitable building, it is necessary to make definite estimates of the probable extent of the underground work, the ultimate number of subscribers it will be desired to handle at the proposed exchange, the probable number of trunks to other exchanges, the probable number of extra territorial lines, the amount of private wire business, the probable average number of calls per subscriber per day when the switchboard attains its ultimate capacity.

A careful estimate of this kind determines the ultimate capacity of the switchboards, underground cable runs, etc., and consequently fixes the minimum size of the building.

In order that the building may fulfill the requirements of a modern telephone exchange, a technical expert should be provided with these estimates and his opinion taken before any land is purchased or building erected. He should co-laborate with the architect in making the building plans. Mistakes have already been made by telephone companies in adopting plans of good office buildings, and afterwards placing the switchboard wherever room could be found. Such buildings have been found unsuitable for modern telephone exchanges. It does not follow from this that the requirements of a good telephone building are necessarily incompatible with the demands of an office building.

One of the first matters to be considered in planning the building is the handling of the underground cables. The system for bringing in the cables should be thoroughly flexible, and permit of the drawing in and out of any particular cable when the point of ultimate equipment is reached. The cables are to be extended through the basement to vertical rows of ducts or to a suitable cable shaft, extending to the cable terminal room. The massing of the cables in rows of ducts exceeding two in number should be avoided. Wherever it is necessary to pass from one system of ducts to another system, the cable should be brought into a vertical row, thus rendering each cable accessible.

Before any building plan is adopted, a complete working plan for the handling of the underground cable should be made. This working plan should show the exact location of every cable in the subway at each turn, and the location of its inside terminal.

It is preferable to head up cables in a terminal containing a sneak current and lightning arrester. The sneak current arrester should operate with the current of .3 of an ampere in 40 seconds, and the lightning arrester should operate when the potential of the wire rises to 300 volts. By using a combined cable head and strong current arrester, economy and space as well as inexpense is insured. The strong current arrester should be so designed that the lines can be tested at this point by using suitable plugs.

The terminal room should also contain a distributing board and chief inspector's desk. The most economical, compact and flexible distributing board that has yet been devised, is that known as the "Hibbard Iron Distributing Board." The cable terminals should be connected with the line side of the distributing board by flexible cable, all connections being soldered. The switchboard cables terminate on its other side.

For cross-connecting wires, okonite wire No. 20, B. & S. gauge, insulated to $\frac{1}{16}$ of an inch, twisted in pairs, should be used. All connections being soldered.

The chief inspector's desk should be located immediately in front of the distributing board and should be provided with a telephone outfit, Morse key and relay, Wheatstone bridge and galvanometer and loops extending to the power and battery room, local switchboard and chief operator's desk. It should be provided with testing plugs for use at the strong current arrester.

Near the terminal room should be located a power and battery room and in this room battery racks should be provided, upon which the operator's transmitter batteries and chief inspector's testing batteries can be located. The battery rack should be wired with waterproof wire in a permanent manner.

In this room a generator switchboard should be provided, and have terminating upon it loops to the various portions of the multiple board and also the terminals of all generators. Electric motors, water motors or other suitable power supply, should be located here. Both the terminal room and battery and power room should be so placed that it will be possible to enter them without passing through the operating room.

On the same floor and adjacent to the terminal room should be located the operating room. This room should be large and well ventilated, free from elevator shafts, columns or other obstructions. The switchboard should commence at the end of the operating room nearest the terminal room and extend from it in a straight line.

If it becomes necessary to deflect the switchboard from a straight line, it should be arranged so that the operators sit inside of the curve. This enables the chief operator's desk to be so located that all parts of the switchboard are visible from this point. The size of the room necessary will depend upon the ultimate capacity of the switchboard.

If the switchboard is to have an ultimate capacity of 4,000 lines or over, the extra territorial trunk section should be the first in the system. It should be equipped with five-point spring jacks and three-point plugs, so that when line is in use at the trunk section, it tests busy at the other boards.

If a switchboard is to have a capacity of less than 4,000 lines, the trunk board should be made the last section in the system, and the regular Chicago spring jack used. The reason for locating it last in the system is as follows: Whenever a metallic circuit connection is made at any section, an open leg is attached, which extends throughout the rest of the board to the answering jack, the open leg being shortest on connections made at the last section. In large boards, this introduces an appreciable amount of cross-talk. By making the trunk line section the last section in the board, all connections made at this board have a minimum length of open leg and consequently the switchboard cross-talk is reduced to a minimum.

The answering jack should be the last spring jack in the system, thus insuring, in every connection, at least, one of the parties connected having no open leg attached to his circuit. If the answering jack were the first spring jack in the section, every connection would have at least one open leg attached to it extending throughout the whole system.

Next to the trunk section comes the regular multiple board, the number of sections depending upon its present equipment. It has been found that sections of multiple board six panels wide, of the hog-trough type and having an ultimate capacity for 300 subscribers' drops, is the most desirable form of multiple switchboard. On the back of the hog-trough are to be located tubular clearing out drops and tubular subscribers' drops.

Immediately back of the hog-trough is to be located a cord shelf upon which both cords are to be placed.

In the face of the board, immediately above the cord shelf, are to be placed the answering jacks; above the answering jacks, the subscribers' jacks.

The standard condenser listening and long distance ringing keys with talking contacts of platinum have been found to give most excellent service. On the framework, immediately under and back of the cord shelf, is to be located an intermediate distributing board. It has been found that it is possible to so distribute the busy subscribers with those that are not so busy, as to make approximately equal the work for all the operators. In order to do this without changing the number of the subscriber, the intermediate distributing board has been designed. One side of this board is connected to the answering jack and subscribers' drop, and the other side to the cables coming from the multiple board.

By placing two numbers on the subscribers' drop, one on the shutter corresponding with the answering jack and one on the face plate corresponding with the spring jack number in the multiple board, it is possible to make cross-connections at the intermediate distributing board and not change the drop number of the subscriber.

A change of this kind will be effected as follows: Suppose that the operator upon which subscriber No. 654 terminates, was very busy, and that the operator upon which subscriber No. 235 terminates, was not so busy; and, also, that the subscriber No. 654 was a very busy wire, and subscriber No. 235 was not a busy wire, it would be desirable to interchange the answering jacks of these two subscribers, for, by so doing, the work of the operators would be more equally divided. This would be done at the intermediate distributing board by cross-connecting the two answering jacks and by changing the face plates on these two subscribers' drops. The office record of circuits should be so constituted as to admit of this dual numbering of drops.

The double track system for intercommunication between offices is recommended.

Push buttons, connecting local operators with the talking circuits, are to be placed within easy reach in front of each operator.

All incoming trunks should terminate on single cords and be operated by a call wire system. For this purpose the incoming trunk line operator has his head telephone included in the talking circuit from the other exchanges. The trunk circuits should be arranged so that if the calling wire breaks down, any other trunk line may be quickly substituted, and, pending the change, the trunk lines operated by drops.

It is also desirable to have the circuits so constructed that when the operator at the originating office disconnects a trunk line, the operator at the receiving office is notified automatically by special signal. This reduces the number of calls on the talking circuit one-half.

In front of the switchboard, in such a position that all sections may be easily seen, a monitor desk should be placed. This desk should have, terminating on spring jacks, loops extending to each operator, to the chief inspector's desk and to circuits in the multiple board.

All operating rooms should be carpeted with linoleum to prevent noise by people walking about.

On the same floor as the operating room a cloak room and lunch room should be provided. The lunch room should be equipped with tea and coffee urns, lunch table, etc.

By providing such conveniences for the operators, a better class of women become available and exchange service correspondingly improved.

In closing these remarks, I would call attention to the necessity of providing complete working plans and specifications of the proposed equipment, including the cable run, before the construction of the building is commenced. Extensive alterations in buildings and apparatus already made in several of our central offices would not have been necessary had this been done. Such plans are as necessary to the successful and economical erection of a modern telephone exchange as are the plans for the erection of a suspension bridge or other engineering work.

The president called Mr. A. W. Crandall to the chair, and stated that the two papers just read would be discussed together.

Mr. C. H. Wilson called attention to the suggestion that the operating room might be on the top floor or street floor. Would like to know which was the better location. Preferred the top story.

Mr. Hibbard thought the advantages of the top floor were very great, on account of coolness, light and isolation. Thought elevators should not run into the operating room.

Mr. Pickernell said the question of getting rid of street noises was a very important one in the cities.

Mr. Patterson said that he did not advocate the lower floors in all cases. The heating and ventilation of a room should be independent of windows.

Mr. Gifford stated his exchange, at Louisville, was on the second floor, rear, in a fireproof building. Got plenty of light from the top. Mr. Gifford described at some length the very excellent arrangement he had made for getting in cables, etc. His building was heated by steam and lighted by electricity. Favored having a room with the protectors, cable ends, etc., to which only one man would be permitted to enter and be alone responsible.

Mr. Carty thought more than one employé should have the privilege of entering such room.

Mr. Hibbard said the question of current arresters was a very important one. There were a great many of these inventions; his own name was attached to one, but he knew experts who claimed to be able to burn down a building through it. Didn't favor locking these arresters in a room with no one to watch them.

President Sargent returned to the chair and announced that Mr. Carty would speak on "Bridging Bells."

Secretary Barney announced the resignation of Mr. C. E. Bailey, as honorary member, and stated that the gentleman was now connected with a company which was an active member of the Association. Resignation accepted.

Invitations to the banquet to be given by the Telephone Company of Detroit, at the Russell House, Wednesday evening, and to a boat ride, tendered by the same company,

on the lake, for Thursday afternoon, were announced and received with applause.

Mr. Carty then spoke without notes as follows on the subject above announced, illustrating by means of crayon and screen:

"Bridging Bells."

BY J. J. CARTY, OF NEW YORK.

After describing the looping-in system which is generally in vogue, and which is a legacy from the early telegraph men, who are the pioneers in telephony, he fully explained its defects. He gave as an example a 50-mile iron wire between San Jose and San Francisco, containing eight stations connected on the looping-in principle. Over this line it was almost impossible to talk. But on the same pole was another line without any way station which worked very well. This way line with the looped-in stations was equipped with Carty's bridging bell, and the result is that the talking over the way line is now equal to that on the through line. He then showed that by the simple substitution of those new bells, a new line 50 miles long was practically added to the plant. When viewed from this standpoint, it was shown that the value of any telephone plant at present equipped with the ordinary bells could be increased to an extent measured only by thousands of dollars, and when it is understood that the great bulk of the telephone lines having more than one station on them are operating with the old plan and are consequently working at a very low efficiency, or, to be more correct, are not working at all, the money value of this system to the telephone companies at large is not easy to estimate. This bell is not only adapted for grounded circuits, such as the San Francisco line, but is of peculiar value in metallic circuits. Mr. Carty stated that from a large number of experiments which were made by Mr. Hibbard, Mr. Pickernell and himself, on a line containing 20 stations equipped in this manner, it was impossible to distinguish between talking over it and talking over a line containing only two stations.

The general plan of this system resembles closely the modern plan of alternate current working, using a low resistance generator, having permanent magnet field magnets, and in the exterior circuit using high resistance units, the field magnets being wound with a thousand ohms of No. 33 silk covered copper wire, thus giving an immense number of convolutions. By this means the ringer magnets have a very high co-efficient of self-induction and consequently absorb but a very little of the talking current. As the telephone transmitter is essentially a self-regulating dynamo with a moderate output of current, the branching of these units or ringer magnets in the circuit is absolutely without harmful effect on the current which operates the receiving telephone. Although each of the magnets consumes a certain amount of current, they also increase the output of the transmitter and act in a manner analogous to the working of incandescent lamps in the well-known multiple arc system.

Mr. Carty did not claim any originality for the bridging system *per se*, but exhibited and described a bell of special design which represented the only way of successfully operating the bridging plan for a large number of stations or for any length of line. The mechanical design of the bell contained many important improvements which have not hitherto found their way into bell construction. Mr. Carty fully illustrated his system by numerous charcoal sketches, and showed that in addition to assuring a perfection of operation never before obtained, that the new plan resulted in most important savings in construction.

It was brought out in the discussion that the bell was entirely beyond the range of experiment and was in successful use on important lines at New York, Boston, San Francisco, Albany and elsewhere.

Mr. R. M. Bailey said there were many corporations who desired to have several telephones on a circuit which could be reached without calling central office. Mr. Carty's idea would help out in this respect. On long lines he thought there might be danger from lightning. His company had a system somewhat similar to the one proposed by Mr. Carty, and they had made special provisions for protection by means of a shunt wire.

Mr. Wilson saw only one difficulty in Mr. Carty's bridging plan—that of locating trouble. Favored the bridging scheme, unless you could have independent lines.

Dr. Culverson thought the bridging scheme a very important one. Had commenced it in Buffalo, using at first the ordinary bell, with poor results. On changing the bells, had much better success, and were now working a number of them with perfect satisfaction. There was a great saving of wire and construction.

Mr. Carty said Mr. Sabin, at San Francisco, had a long line and was able to find where the trouble was but could not make the line work—an advantage that was offset by a disadvantage. (Laughter.) Thought a proper lightning arrester should be tried before undertaking to complicate the bell, which had been simplified in every way possible. He described the method of locating trouble and testing adopted in New York City.

General discussion on the plan suggested by Mr. Carty was participated in by Messrs. Hibbard, Bailey, Wilson, Gifford, Ed. J. Hall, Sr., Farnham, etc.

On motion of Capt. Gifford, the thanks of the Association were tendered Messrs. Pickernell, Patterson and Carty for their papers.

At the suggestion of Mr. Hibbard, Mr. Wilson, of Chicago, explained the use of the Edison current for operating telephones at his central office. A storage battery of five cells was used which gave out about five amperes of current. These are connected in the main circuit that lights the building, storing the electricity at the same time. Mr. Wilson illustrated his method on a screen showing the location and method of handling and centraling the current. Five cells were used to supply between 60 and 70 transmitters, perhaps more, if necessary. His arrangement contemplated 100 transmitters for these cells. A little resistance of German silver wire was inserted and adjusted carefully. Also used the Edison current for ringing instead of a power generator, lamps being inserted to tone the current some. Worked in all cases very well indeed. Proposed to have an auxiliary battery, ready charged, to use in case of accident. Was now arranging to use the storage b ttery in the American District office, which, in Chicago, is owned by the telephone company.

Secretary announced that his statistical report had been prepared, and if there was no objection it would go in the records without reading.

On motion of Mr. Crandall, a hearty vote of thanks was tendered the Michigan Bell Telephone Company and the Telephone and Telegraph Construction Company for their very liberal hospitality.

On motion, adjourned *sine die*, at 12.30 P.M.

The Attendants.

Thomas B. Doolittle, American Bell Telephone Co., Boston.
Wm. A. Hovey, American Bell Telephone Co., Boston.
A. W. Crandall, Great Southern Telephone and Telegraph Co., New Orleans.
H. S. Huidekoper, American Bell Telephone Co., Philadelphia.
Thos. D. Lockwood, American Bell Telephone Co., Boston.
Edward J. Hall, Jr, American Telephone and Telegraph Co., New York.
W. D. Sargent, New York and New Jersey Telephone Co., Brooklyn.
C. H. Barney, Secretary of the Telephone Association, New York.
C. A. Morrison, Stenographer of the Telephone Association, New York.
Geo. A. Hamilton, Western Electric Co., New York.
Arthur G. Fuller, American Bell Telephone Co., Chicago.
Geo. Albree, American Bell Telephone Co., Chicago.
A. O. Morgan.
R. M. Bailey, Central Pennsylvania Telephone and Supply Co., Williamsport, Pa.
A. C. White, Providence Telephone Co.
E. V. Cherry, Standard Electrical Works, Cincinnati.
Flemon Drake, Nebraska Telephone Co., Omaha.
C. W. McDaniel, Missouri and Kansas Telephone Co., Kansas City.
H. B. Thayer, Western Electric Co., New York.
Ed. J. Hall, Sr., Buffalo Bell Telephone Co.
H. C. Palmer, Buffalo Bell Telephone Co.
Jno. N. Culbertson, Buffalo Bell Telephone Co.
Frank B. Knight, American Bell Telephone Co., Austin.
C. H. Wilson, Chicago Telephone Co.
C. D. Crandall, Western Electric Co., Chicago.
J. N. Keller, New England Telephone and Telegraph Co., Boston.
I. H. Farnham, New England Telephone and Telegraph Co., Boston.
J. R. Davis, Pennsylvania Telephone Co., Harrisburgh.
W. T. Westbrook, Delaware and Atlantic Telephone Co., Philadelphia.
Chas. W. Price, ELECTRICAL REVIEW, New York.
C. E. Stump, *Electrical World*, New York.
F. DeLand, *Electrical World*, Chicago.
D. I. Carson, Southern Bell Telephone Co., New York.
James Clark, Ohio Valley Telephone Co., Louisville.
H. N. Gifford, Ohio Valley Telephone Co., Louisville.
J. P. McKinstry, Erie Telephone Co., Cleveland.
W. N. Eastabrook, New York and Pennsylvania Telephone Co., Elmira.
S. Ivers, Southern Massachusetts Telephone Co., New Bedford.
Morris F. Tyler, Southern New England Telephone Co., New Haven.
F. G. Beach, Central Union Telephone Co., Chicago.
J. E. Zeublin, Central Union Telephone Co., Columbus.
J. J. Carty, Metropolitan Telephone and Telegraph Co., New York.
W. A. Jackson, Michigan Telephone Co., Detroit.
F. A. Forbes, Michigan Telephone Co., Detroit.
C. E. Yost, Nebraska Telephone Co., Omaha.
Geo. Y. Wallace, Rocky Mountain Bell Telephone Co., Salt Lake City.
D. S. Murray, Rocky Mountain Bell Telephone Co., Salt Lake City.
Jno. D. McLeod, Wisconsin Telephone Co., Milwaukee.
F. E. Degenhardt, Standard Underground Cable Co., Chicago.
F. A. Pickernell, American Telephone and Telegraph Co., New York.
F. J. Hovey, American Telephone and Telegraph Co., New York.
H. P. Marshall, American Telephone and Telegraph Co., New York.
A. B. Uline, Hudson River Telephone Co., Albany.
H. L. Storke, Empire State Telephone Co., New York.
W. A. Childs, Law Battery Co., New York.
A. S. Hibbard, American Telephone and Telegraph Co., New York.
J. P. McQuaide, National Conduit Co., New York.
Henry D. Stanley, Bridgeport Brass Co.
Cyrus O. Baker, Jr., Platinum, Newark.
E. M. Barton, Western Electric Co., Chicago.
Louis D. Beck, Norwich Wire Co., New York.
J. A. Wetmore, Norwich Wire Co., New York.
J. R. Dee, Michigan Telephone Co., Houghton, Mich.
W. R. Patterson, Western Electric Co., Chicago.
Geo. T. Manson, Okonite Co., New York.
W. F. Collins, *Electrical Engineer*, Chicago.
E. L. Powers, *Electrical Industries*, Chicago.
J. F. Land, Michigan Telephone Co., Detroit.
S. E. Watson, Michigan Telephone Co., Detroit.
W. D. Greene, Michigan Telephone Co., Detroit.
Thos. R. Taltavall, *Electric Age*, New York.
Geo. G. Hall, American Bell Telephone Co., Cincinnati.
L. B. McFarland, Bell Telephone Co. of Canada, Montreal.
J. J. Ghegan, J. H. Bunnell & Co., New York.
Warren Anderson, Miami Telephone Co., Xenia, O.
Jas. Clark, Jr., Louisville, Ky.
D. A. Smith, Empire State Telephone Co., Auburn.
J. W. Dickerson, *Western Electrician*, Chicago.
A. C. Durborow, Jr., *Western Electrician*, Chicago.
Chas. B. Doolittle, Bridgeport, Conn.
W. J. Cole, Southern Bell Telephone Co., Atlanta.
E. P. Meany, American Telephone and Telegraph Co., New York.
J. F. Kelly, Edison Manufacturing Co., New York.
Frank T. Wyckoff, Wyckoff Pipe Co., Williamsport.
M. J. Carvey, Central Union Telephone Co., Toledo, Ohio.
J. M. Brown, American Telephone Co., Washington, D. C.
H. G. Stockwell, National Conduit Manufacturing Co., Portland, Me.
W. H. McKinlock, Central Electric Co., Chicago.
C. E. Scribner, Western Electric Co., Chicago.
J. O. Stockwell, Missouri and Kansas Telephone Co., St. Joseph.
P. Yensen, Erie Telephone and Telegraph Co., Cleveland, O.
Frank A. Magee, The E. S. Greeley & Co., New York.
Gilbert M. Smith, Ansonia Brass and Copper Co., Chicago.
Paul W. Bossart, Detroit Electrical Works, Detroit.
C. E. Mosley, Chicago.

LADIES PRESENT.

Mrs. C. H. Barney, Mrs. A. O. Morgan, Mrs. R. M. Bailey, Mrs. H. C. Palmer, Mrs. John N. Culbertson, Miss Gifford, Mrs. J. P. McKinstry, Mrs. W. N. Eastabrook, Mrs. F. G. Beach, Mrs. J. E. Zeublin, Mrs. H. L. Storke, Mrs. W. J. Cole.

Telephoniques.

A number of traveling parties were formed in the different cities, and each with a guide headed for Detroit. It is reported that one party turned all their funds over to the guide—and realizing his advantage he took such good care of them that a very thirsty and hungry set arrived in Detroit, where they were made happy by the return of their government certificates.

A mineral water famine struck the party containing the high officials of the Association who left New York Sunday afternoon. A bottle of "Belle of Nelson" had been snugly put in the ice cooler, but when the ice was replenished no one for the moment thought of the danger and the bottle was broken. The universal sentiment prevailed throughout the car thereafter that the Lackawanna Railway Company supplied the best water ever found on a railroad, and the telephonists became so thirsty that they had to fall in line in front of the water cooler. One gentleman remarked he "wouldn't take three dollars for his thirst."

The gentleman who gave the President of the Association a bottle of salt and water for Appollinaris, which was partly drank before being noticed, wondered afterwards why he wasn't recognized in the Convention. He said he never had so much trouble in catching the presiding officer's eye. He will know he was found out when he sees this.

There was a good deal of quiet fun over the election. It was generally known that the president, vice-president and treasurer were to be re-elected, yet each gentleman on being elected, stood up and expressed great "surprise" in a manner that paralyzed the audience. When it came Treasurer Storke's turn to be re-elected, the entire Convention sat quite still, as though every one understood what was up, and finally Mr. Storke was told that he "would have to nominate himself." This embarrassing situation, which was enjoyed as much by the victim as by any one, was finally relieved by Angus Hibbard, and Mr. Storke was re-elected and called on for a speech. His reply was to the effect that he had no doubt of his election being unanimous, as the silent way in which he had been nominated was a clear case of "silence giving consent."

Mr. W. A. Jackson covered himself with glory as a generous and thoughtful host. He was most ably assisted by Mr. F. A. Forbes, the general superintendent of the Michigan Company. The telephone people were never more handsomely entertained.

The new wall telephone set by the Long Distance people was greatly admired. It is manufactured by the Western Electric Company, and is literally in the highest style of the art.

The ELECTRICAL REVIEW was received at the Convention early Tuesday morning, and was eagerly sought for by all the earnest telephone men present. The interesting account of the new telephone exchange in New York was read and favorably commented on by all.

Mr. J. J. Ghegan, representing Messrs. J. H. Bunnell & Company, was present with a line of Burnley batteries, which were exhibited in the hotel corridor. This battery is highly spoken of by those who have tried it, and it is fast gaining ground in telephone circles.

The Norwich Wire Company was represented by the president, Mr. Louis D. Beck, and Agent J. A. Wetmore. A number of samples of this new wire were exhibited and closely inquired about by the delegates.

Mr. Beck made many new friends in telephone circles.

The Entertainment Provided at Detroit.

The Michigan Telephone Company and the Telephone and Telegraph Construction Company, through Mr. W. A. Jackson and Mr. F. A. Forbes, treated the visiting telephonists most handsomely. Wednesday afternoon all were taken on a drive about the beautiful city of Detroit and through Belle Isle Park, and in the evening an elaborate banquet of 100 plates was served at the Russell House. Out of respect to President Sargent, who sojourned so long at Paris last year, the *menus* were printed all in French. Mr. Sargent appreciated the compliment, and delivered some timely and eloquent remarks, part of which were in the court language of Europe. A number of toasts were wittily responded to at the end of the banquet, remarks being made by Messrs. Tyler, Storke, Gifford, E. J. Hall, Jr., Crandall, Lockwood, Barney and others. A feature of the after-dinner entertainment was the singing by the Electrical Choir, under the leadership of the one and only A. S. Hibbard.

Thursday afternoon the fine steamboat "City of Detroit" took all the visitors up the lake to the St. Clair flats, the ride being particularly enjoyable. A lunch, which was a perfect one, was served during the trip.

In all the many details that go to make up perfect entertainment of a large party, the arrangements planned by Messrs. Jackson and Forbes have never been excelled, and these gentlemen were almost overcome with the shower of thanks and cheers they received as they were bidden good-bye.

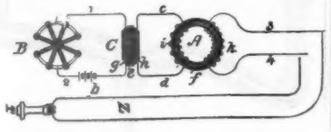
The Detroit Convention will long be remembered as one of the most enjoyable social events of telephone history.

More Strauss Cylinders.

Fourteen big funnels running down to as many phonographs surrounded Edouard Strauss and his orchestra at the Madison Square Garden, last Thursday night. The following selections were recorded on the cylinders and will be preserved: The overture to the "Thievish Magpie," by Rossini; the "Boccaccio Waltz," by Edouard Strauss; selections from the "Mikado," the "Phonograph Polka," dedicated to Thomas A. Edison, by Edouard Strauss; "A Night Song," by Von Behr, and Strauss' new "Vienna Waltz."

RECENT ELECTRICAL PATENTS.

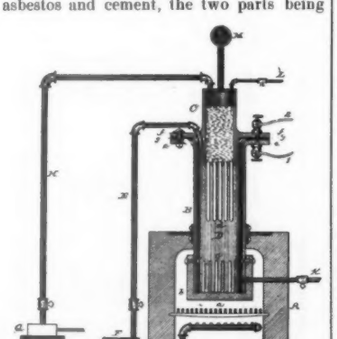
A recent patent has been issued to Thomas D. Lockwood for an improvement in telephony, in which a transformer having a closed magnetic circuit is used to raise the potential of the telephonic currents. The principle of the invention will be understood from the accompanying engraving, in which B represents a microphone placed in the circuit of a local battery and connected with the primary of an induction coil C. The primary and secondary windings of this coil are of the same size of wire and the same number of convolutions, its only function being to produce reversals or alternations of current in a local circuit *e d*, charging the primary of the transformer A, the secondary of which *k* is connected to line. In the ordinary telephonic apparatus, the primary circuit contains very slight



fluctuations of current such as are due to the variations of contact in the microphone. By the arrangement described, the induction coil C simply performs the function of reversing current, and the reversals, by acting inductively through the instrumentality of the core of the transformer A, are claimed to produce wide variations of potential in the telephone circuit.

A NOVEL ELECTRIC GENERATOR.

In the accompanying engraving is illustrated an electric generator recently patented by Mr. Edison, in which it is proposed to develop a current by dry chemical reactions occurring in a chamber containing a rarefied atmosphere, an external source of heat being used to maintain the chemical reaction and increase the conductivity of the rarefied atmosphere. The apparatus consists briefly of a furnace A provided with grate bars *a* over which is mounted a flanged tubular vessel B having a thick cast iron bottom plate *b* within the furnace. On the inner surface of the bottom plate are upwardly projecting iron rods or electrodes *c*. Upon the top of the vessel B is supported a steam boiler C having water tubes *d* projecting downwardly into the vessel B. The vessel and boiler shell have projecting flanges *e f* between which is an insulated packing of asbestos and cement, the two parts being



held together by suitable insulated bolts. The boiler closes the top of the vessel, forming reaction chamber D, in which the chemical reaction takes place. Entering this chamber D is a pipe B extending to the inlet of an air pump F, worked by a steam engine G, supplied with steam from the boiler C by a pipe H. A pipe I extends from the outlet of the air pump to the fire box of the furnace. K is the pipe for admitting water or steam to chamber D. L is a feed water pipe of the boiler, and M the steam gauge. The circuit connections 1.2 connect with the two parts of the chamber. Upon the bottom of the chamber B is placed a reducible or oxidizable substance, such as a metal or metalloid, and a gaseous liquid with which it will readily combine is admitted to act upon it; or a non-metallic material like carbon might be used. It is stated that finely divided iron when placed in the chamber and brought to incandescence, while steam or water is admitted to the pipe K, yields efficient results, the oxygen of the watery vapor combining with the metal and the liberated hydrogen charging one pole while the iron charges the other. The operation is maintained continuously by keeping up the heat and admitting a continuous stream of steam or water. A continuous exhaustion in the chamber is maintained to assist reaction. It is stated that carbon and oxide of lead, when mixed together and placed in the bottom of the box, forms an efficient material for the development of the current, the oxygen of the oxide of lead, under the action of the heat, combining with the carbon, and producing carbonic oxide, which rises in the chamber, charging one pole while the reduced lead charges the other pole.

Habeas Corpus for Jugigo Denied.

Shibuya Jugigo, a Japanese murderer, is lying in solitary confinement in Sing Sing prison under sentence of electrocution. On September 10th, lawyer Roger M. Sherman, of this city, presented to Judge Lacombe in the United States Circuit Court, an application for a writ of *habeas corpus* to produce his client in court.

Mr. Sherman says in his petition that "the State of New York, its officers and agents, have in their possession or control for that purpose only certain dynamo electrical machines, the use of which cannot cause to pass through the human body a current sufficient to cause death by its intensity, but that the use thereof will cause an infinite number of discontinued currents to pass through the body, with the result that it will be carbonized from the surface until he shall yield up his life as a result of fiendish and inexpressible torture; that while the application of the force from said machine to petitioner's body would kill him, that result would only follow the reduction of his resistance gradually; that whether or not he would be unconscious during these tortures would depend upon his ability to endure pain." Lawyer Sherman concludes, therefore, that the State is not prepared to legally execute the sentence as pronounced.

In the afternoon of the same day Judge Lacombe handed down a decision, briefly denying the writ, as follows: "In Kemmler's case the Supreme Court held that the statute was not obnoxious to the provisions of the Federal Constitution. The papers presented upon this application do not indicate that the relator is to be punished otherwise than in accordance with the terms of that statute. The writ is refused."

What's in a Name?

London *Electrician* calls attention to some curious coincidences between the names of inventors and mechanical appliances which have given rise to absurd mistakes. It was commonly supposed years ago that the Brush machine was so called on account of some special kind of brushes, and that the Lever arc lamp derived its name from two peculiar levers in its mechanism. "The Ball dynamo has no spherical armature, as might be supposed. The Short electric railway system is not specially adapted for lines of limited length. Bright shackles are never polished, and the Siemens galvanometer has nothing to do with the mariner's compass, with which beginner's sometimes confound it. The Parsons engine is not a clerical device, and the Upward battery has nothing in common with Excelsior carbons. Such popular errors may be excused, however, when we find a recognized text book explaining the Daniells cell as being so-called because of its constancy!"

Mrs. Gummey.—Edison says that no experiment which he has tried at night ever failed.

Gummey.—Then he never tried to walk his baby to sleep.—*New York Sun.*

The Steel Ship "Segurança."

A new steel steamship, planned, built, fitted and equipped by Americans, in America and for American trade with South America, is called the "Segurança," which is Spanish for "security." She belongs to the United States and Brazil Mail Steamship Company, and was designed by and built under the supervision of Captain A. M. Lachlan, of this city. She can carry over 4,000 tons, with a draught of about 19 feet, and can spin along, when necessary, at the rate of 16 knots per hour.

The "Segurança" was thrown open for an inspection of her electrical equipment on the evening of September 11.

This was an interesting occasion, for the reason that the "Segurança" is the first ship in which the electrical plant was installed under the very rigid rules prescribed for electrical installations by the United States Standard Ship Owners, Builders and Underwriters' Association. The plant consists of a 400 light Continental dynamo coupled directly to a 27 horse-power Ball compound engine run at 100 pounds pressure. The armature makes 400 revolutions per minute. The ship is wired for 350 lights, and on the bow is placed a 4,000 candle-power Hunting ton search-light. The lamps are of 16 candle-power and are so disposed as to give the greatest illumination possible.

The installation is by the Complete Electrical Construction Company, of New York, and was under the direct supervision of Mr. John A. Seely. r. Seely has displayed his usual good taste and ability in putting in this plant. The new flexible mouldings recently patented by Mr. Seely have been used wherever possible. This moulding is made of a flexible insulating material and carries two wires, which are covered with the ordinary insulation before being embedded in the moulding. Of course, the width of the moulding varies with the size of the wire and the work for which it is designed. It is attached to the ceiling or walls by flat headed tacks, placed about a foot apart. When in place, the moulding, after being painted, thoroughly harmonizes with its surroundings, and it is very often impossible to tell where the carving on a stanchion or beam stops and the moulding begins.

At each light is a fuse embedded in a device made of Seely's compound which is absolutely fireproof. If a fuse is blown, all that is necessary to be done in order to restore the plant to its normal capacity is to unscrew a section of the fusible box, about two inches long, insert a new fuse and replace the top of the box; this, of course, can be done in a very short time. As has been said, all the lights are arranged on a two-wire circuit, and the ship is not used as the return, as has been done in some instances. It is, without doubt, the safest and most reliable marine installation that has ever gone out of the port of New York. How well the work on the "Segurança" has been done, may be judged from the fact that in the smoking room is a certificate handsomely framed which states that the ship and its equipment is built "in excess of requirements."

On the propellor shaft is arranged an eccentric which operates a little electrical contrivance connected with a dial placed in front of the pilot. This infallibly shows, by the operation of a pointer, whether the ship is going ahead or astern, and is of great service in going into port or into a narrow space between two piers. Immediately the shaft begins to revolve so as to send the ship astern, the pointer flys to the word "back" on the dial, and when she goes ahead the pointer flys to the word "forward," so that at all times the pilot or the officer in charge is aware of the exact movements of the propellor. The ship is supplied in the ordinary way with electric calls and bells.

Everything which can possibly add to the comfort of the traveller on the long voyage to South America is included in the ship's equipment.

The "Segurança" sailed on Saturday, September 13th, on her maiden voyage to Bolivia and Rio de Janeiro.

TELEGRAPHIC

.... A union telegraph company has been organized among the Cass county, Mich., farmers for private convenience.

.... The directors of the Western Union Telegraph Company, on September 10, declared the quarterly dividend of 1¼ per cent., payable October 15. The comparative statement of the company for the quarter ending September 30 shows a net revenue of $2,000,000, an increase of $250,000 over 1889; surplus, July 1, $9,962,983, an increase of $1,351,582; total, $11,962,983; increase, $1,501,582; interest and sinking fund, $243,200; increase, $32,200; balance, $11,719,783; increase, $1,568,382; dividend, $1,077,400; increase, $15; surplus, $10,642,383; increase, $1,568,367.

.... The annual meeting of the New England Printing Telegraph Company was held at the executive office of the company, 113 Devonshire street, Boston, last week. The following board of directors was elected: Frank B. Dole, Boston; John R. Reed, Westfield; P. S. Jennings, New York; Abner McKinley, New York; James P. Cook, Boston; Geo. W. Slade, Fall River; Maybin W. Brown, Boston. At a meeting of the directors, Frank B. Dole was elected president; R. H. Waters, treasurer; H. B. Humphrey, secretary; Maybin W. Brown, general manager; C. F. Hutchinson, general superintendent; executive committee, F. B. Dole, Abner McKinley, James P. Cook, Geo. W. Slade.

Deposited Copper Tubes.

The Elmore Patent Copper Depositing Company (Limited), of London, is taking orders for deposited copper pipes of any sizes up to three feet four inches in diameter, and ten feet long. The material of these pipes has a tensile strength of over 25 tons to the square inch, and an elongation of over 14 per cent. in four inches. After the experience of recent failures in copper steam pipes, it is a relief to find that there is a pipe now made free from welds and joints of every kind, that offers absolute security with the high pressures now employed. Each pipe has etched upon it the results of a test which is made of a strip cut from its end. The pipe consists of pure copper, free from admixture with other metals, and the only variation which can occur is in its hardness. It is possible to produce hard or soft metal at will, according to the purpose for which it is to be employed.

The method of making these tubes consists in depositing the copper, by means of an electric current, upon a mandrel which is rotated in the solution. An agate burnisher travels along the mandrel, rubbing the particles of copper as they are formed into those beneath them, thus forming a fibrous plate of perfectly uniform structure and great strength. The speeds of mandrel and burnisher are so adjusted that only a very fine film can form between two applications of the burnisher to the same spot. The mandrel is covered with black lead, and after it is taken out of the bath the copper is rolled; this causes it to expand, when it can easily be slipped off.

Copper electrotypes are deposited with a current of six amperes per square foot. Each ampere deposits .00033075 grams per second. Working day and night for six days (144 hours), there will be deposited on a square foot 1.026 grams, or 2¼ pounds of copper. This would give a plate $\frac{1}{10}$ inch thick.

The Elmore copper steam tubes are deposited at the rate of $\frac{1}{4}$ inch in thickness per week of 144 hours, or six pounds per square foot of surface.

It requires an electromotive force of from two to three volts to effect the chemical reduction of copper sulphate solution, and if we assume the combined efficiency of engine, dynamo, leads and bath, to be only 25 per cent., then each indicated horse-power will deposit 888 grams, or 1.95 pounds of copper per hour. This shows a ton of coal used in a modern engine will deposit a ton of copper.

* * Battle Creek, Mich., wants an electric railway.

* * The electric railway company in Augusta, Ga., now operates 48 cars.

* * The Seattle, Washington, Electric Railway Company is extending its system.

* * The streets of Wheeling, W. Va., are still blockaded by the strikers, who are determined the electric cars shall not be run over them.

* * By the Hollerith electric system of enumeration, the population of the whole earth (estimated, including Asiatics and savages, at 1,300,000,000) could be counted in 200 days.

* * The mayor of Chester, Pa., has signed the ordinance for an electric railway and the inhabitants of that city are jubilant. The ordinance has been fought through councils since last March.

* * Experience has shown that an electric street car can be comfortably heated by the expenditure of one horse-power of electrical energy. The electrical heaters do not reduce the seating capacity of the car, which is kept clear of coal dust and cinders.

* * Surveyors in the employ of the Whitman, Mass., Electric Road Company have been at work the past few days between Whitman, and Brockton. The work will be rapidly pushed to completion. The proposed route, according to one of the leading stockholders, will be from East Whitman, near Winter street, up South avenue, turning to the right, down Washington street as far as West street, where it will be extended to the Brockton line. The road will be operated from the Brockton end, that is, the motive power will be supplied by the East Side Company. The new location of the Brockton Company on Main street, in that city, has had much to do in arranging a definite settlement.

Electricity by Tidal Power.

A cablegram from Paris states that steps are being taken to form a company to work out the project of M. Decœur for supplying Paris with electricity by means of water turbines at the entrance of the Seine. It has been shown by engineers, among them M. Eiffel, that the idea is perfectly feasible. It is thought that a large part of the capital will be subscribed from London, as British syndicates are snapping at everything which promises to pay a dividend, and the profits on M. Decœur's scheme are calculated at 8,500,000 francs per annum.

The idea is to utilize the ebb and flow of the tide. At Cape La Hene, at the entrance of the port of Havre, two large basins will be constructed, connected with each other. In the one the tide will flow in over a dam, while during ebb it will flow out to sea again from the other basin. At inlet and outlet, it is proposed to construct a number of powerful turbines for transmitting the energy of the water. The tide rises and falls 18 feet at the mouth of the Seine, which is calculated to give six horse-power of energy to every hectare of basin area. It is also intended to inclose an area of 7,000 hectares between the sea and the Seine by means of a dam 16½ miles long, between Havre and Tancarville. This, according to the projector, will give an energy of 42,000 horse-power, which can be transformed into electrical energy and transmitted in the form of currents to Paris, and further if need be.

M. Decœur is very sanguine as to the results, and says that his scheme will revolutionize the present method of generating electricity for commercial purposes.

Mackite Plaster Board.

Mackite plaster boards were invented and first used in Germany, where, during the past three years, in spite of the conservatism of that country, they are said to have had an enormous sale and constantly increasing popularity.

Instead of sawed laths, as used by us, it has been the practice in Germany to apply plaster to tough reeds held in place on the walls or ceilings by wires bent back and forth between small nails driven into the studs or beams. These reeds, found in Holland, and to some extent cultivated in Germany, are very plentiful in various parts of this country. They have a glazed surface, preventing the absorption of moisture, and a strength and toughness almost equal to that of bamboo of the same size. These reeds are the foundation material in the manufacture of Mackite plaster boards.

The boards are generally eight feet long, and reeds of the same length being placed in the molds in which the boards are made, a mixture of water, plaster of Paris, fibre, ground cork, etc., which is used, is poured over them, and worked around them so that when the board is dry the reeds shall be nowhere exposed. The reeds give the boards longitudinal strength, enabling them to be used and handled in these lengths; the fibre makes the boards tough, elastic and strong transversely; the cork waste increases their sound-deadening qualities, while the plaster of Paris makes them a solid fireproof board, furnishing the rough base for the hard finish coat which is applied to them after they are nailed in position.

FIG. 2.—DETAIL A, MACKITE WALL.

FIG. 3.—DETAIL B, MACKITE WALL.

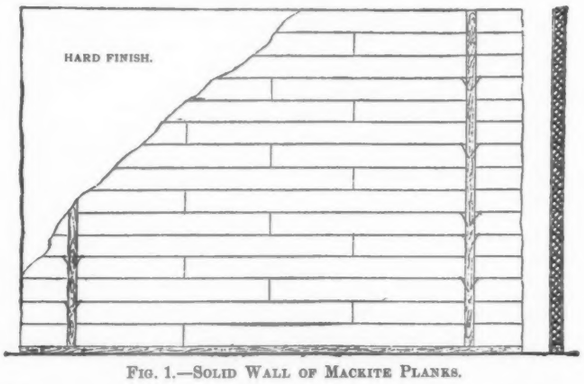


FIG. 1.—SOLID WALL OF MACKITE PLANKS.

The boards are easily and rapidly nailed in place, tinned wire nails with large heads being used. As soon as the joints between them are filled with plaster, the skin or hard finish coat may be applied, and, as this dries quickly, the building is immediately ready for occupancy.

Boards of five-eighths of an inch to one inch in thickness are generally used to take the place of lath and plaster, but Mackite is also made in the form of planks of all thicknesses and of hollow blocks of various sizes; and, in whatever shape it may be put, Mackite is, as a fireproof material, said to be unequaled for lightness, economy and convenience and rapidity of construction.

It has been suggested by insurance men that the proper way to construct a switchboard is to build it of some non-combustible material and then isolate it from the rest of the plant by inclosing it within a fireproof structure. It seems to us that this new material could be very properly used for such a purpose and, indeed, the switchboard itself might be constructed of Mackite boards.

Our illustrations show how a section of wall is constructed of this material.

Between upright timbers or studs placed at suitable distances Mackite planks may be fitted and held by nails, as shown in the elevation or held by wide strips which, covering the stud and joints, will be left as a finish showing in the room, as shown at Detail A.

Detail B shows a method proposed by Mr. Edward Atkinson, of Boston, in which the timber is to be somewhat thicker than the Mackite planks, the latter held in place by moldings fastened at the four corners of the timber, the two faces of the timber being dressed and finished.

This construction seems the better of the two, as it does away with the flue-like spaces between the studding, which are so great an objection to the ordinary partition wall.

The Eastern Plaster Board Company, 52 Broad street, this city, is the manufacturer of Mackite.

British Opinions.

Mr. Thomas Connolly, electrical engineer, of Manchester, England, and Mr. Alfred Stevens, mechanical engineer, from London, are in Pittsburgh, the guests of Superintendent Morris Mead, of the Bureau of Electricity. The visitors are in this country combining a pleasure trip with the purchase of machinery for the English factory of the Okonite Company. They express great admiration for the ingenious ideas of Americans in machinery, and find that we are away ahead of them in this particular. Our electric lighting they consider simply magnificent. The street pavements of America come in for their condemnation, however.

American Institute of Electrical Engineers.

The forty-seventh meeting of the Institute was held on Tuesday evening, September 16th, at the house of the American Society of Mechanical Engineers. The following subjects were discussed:

Report of the Standard Wiring Committee on a definite practical standard resistance of copper.

The adoption of an American name or names for one or more of the practical electrical units.

A 10 horse-power electric motor operates a large gang saw and a pump in a Dubuque, Ia., stone yard.

The main Boston office of the Postal Telegraph Cable Company has been removed from 177 to 234 Devonshire street.

A Malleable Iron Break Arm.

In the varied electrical industries, as in other mechanical lines, the old and heavy cast iron appliances are being supplanted by lighter and neater ones of wrought or malleable iron. Quite recently we described a malleable iron wall-bracket, made by the Great Western Electric Supply Company, which marks another step in this direction. The same firm is now putting out the Chubbuck break arm, which is also made of malleable iron and is claimed to be stronger, lighter and tougher than the forms now in use. Our illustration shows the rather neat design, with the strengthening rib and taper screw, as in the Chubbuck Springfield bracket.

CHUBBUCK BREAK ARM.

The star-shaped section of the arm gives great strength, while the hollow split screws have a slight spring and grip the insulator firmly. Another new feature is the small barbed pin used. As this is made for a ⅝ inch hole, the cross-arm is weakened much less than by the 1½ inch holes needed for other break arms. Moreover, when once driven in, the barbs catch in the wood, holding the arm firmly in its place.

Quicksilver Production.

A census bulletin just issued, gives the following figures for the production of quicksilver during the last decade:

THE WORLD'S PRODUCTION OF QUICKSILVER FOR TEN YEARS.

Year.	Total of All Mines, United States.	Almaden Mine, Spain.	Idria Mine, Australia.	Italian Mines.	Total Foreign Mines.	Grand Total, Yearly.
	Flasks.	Flasks.	Flasks.	Flasks.	Flasks.	Flasks.
1880	59,926	45,832	10,510	3,410	59,949	119,168
1881	60,851	44,989	11,333	3,760	60,082	120,933
1882	63,732	46,716	11,663	4,110	62,489	115,221
1883	46,725	49,177	13,159	6,066	68,394	115,119
1884	31,918	48,096	13,967	7,850	69,915	101,833
1885	32,973	51,818	13,503	6,985	66,281	98,254
1886	32,991	53,199	15,166	7,675	73,070	106,061
1887	33,760	53,276	14,676	8,075	75,027	108,787
1888	33,250	51,852	14,982	9,880	76,664	109,914
1889	36,464	49,477	15,295	10,000	74,772	101,236
Total	407,675	435,939	139,357	66,440	685,936	1,093,611

A flask contains about 76½ pounds of the "liquid metal." The value of the product in the United States for the past 10 years was $13,480,500. The total production outside of this country was 685,936 flasks, while the United States furnished 407,675 flasks.

Salt Lake City, Utah, now has 15 miles of electric railways, and expects to increase this to 50 miles within a year.

Duplex Gas Engines.

BY ELMER A. SPERRY.

It was Prof. Fleeming Jenkin who first gave to the world the mathematical demonstration of the increased economy attending triple and quadruple expansion in the steam engine.

Prof. Thurston, in this country, in his recent paper on steam engines for electric lighting, has pointed out the extremely high theoretical attainment of the latest forms. He says that in fact these have now arrived "to so perfect a condition that the range for further improvement is probably very narrow, and the gain still to be made must come slowly and painfully." The first named eminent authority has further made the statement that "the actual achievement of the steam engine has nearly reached the limit of the possible."

The efficiency of the steam engine when taken as a measure of the recovery of power from the total power equivalent of the heat employed, following the most improved methods, is only about 10 per cent. when large units of power are considered. To compare this performance with that of the gas engine it is but fair that we take equal units in either case. In the comparison of the two motors as heat engines, size for size, the actual performance of the gas engine is over 200 per cent. better than that of the steam engine, with a vast unexplored region beyond, in the case of the gas engine, giving promise of great improvement and higher economy than the most excellent performance yet recorded.

In considering the great problem of transforming heat energy into mechanical and electrica energy, it may be well to investigate the laws of operation and working of a system that has already realized so much in the direct line of transformation of heat into mechanical motion.

The gas engine is a hot air engine in which the air as it is drawn into the cylinders is charged with a substance which may at the proper moment yield the heat required to increase its bulk, the confining of which develops the pressures utilized in moving the piston. This increase of bulk on ignition and the corresponding pressure of the air, is from four to five times. Thus, if the air or mixture in the cylinder at the time of ignition is 40 pounds, the pressure resulting from ignition is about 200 pounds. The ignition does not cause an explosion, as is usually supposed, but, on the contrary, the inflammation goes forward until a certain pressure and temperature is reached, and at this point is arrested, and further inflammation is developed as the piston goes forward, and the pressure thereby tends to decrease. The writer has seen cards from gas engines in which constant pressure was developed throughout nearly the entire stroke. This is especially the case with lean mixtures, or below 11½ to 1 of ordinary illuminating coal gas.

This system of transferring the furnace, wherein the energy is primarily developed, into the cylinder of the engine itself and there utilizing directly the benefits of combustion, is undoubtedly the greatest step in advance of the present half century in the direction of high economy and efficiency. There is no doubt but that the engine of the future is to have its furnace in its cylinder, thereby eliminating the gigantic waste attending latent heat, which is encountered in the case of steam. The high performance of 1.4 pounds of coal per horse-power per hour in a 10 horse-power engine compares favorably with from seven to 13 in the steam plant of equal size.

This being true, the question is asked, "Why are not gas engines more sought and employed for ordinary power purposes?" The answer to this question can only be found by a study of the performance of the present gas engine, noticing the difficulties encountered and the limited application to the more exacting power consumers, and the devices resorted to in the attempt to overcome some of these difficulties. The greatest evil of the present method and cycle of operation in the gas engine is the want of uniformity of speed in the power developed. This is owing to the fact that usually but one out of four, frequently one out of eight, of the strokes or units of power is available for producing effective results. The others are not only non-productive, but actually consume the energy developed in the one. It is true that engines have been produced that give every other stroke an effective stroke; but this system at best produces irregularity that renders it indifferent for driving more delicate machinery, especially electrical generators for lighting purposes. It is true that dynamos may be driven by existing engines to supply storage batteries with some degree of success. But where direct illumination is required, the noticeable irregularity and throbbing prohibits general adoption.

The gas engine of to-day undoubtedly stands in the same position as the steam engine in 1860, when Charles T. Porter first proposed to develop, double or treble the power from the same weight of material for the same weight of engine, by increasing the number of its power producing elements per minute from 50 strokes, as was the practice, to 250. Or, to follow history in steam engineering still further back, in the days of Newcomb and Crawley, when all cylinders where single acting and a multiplication of cylinders were required to increase the number of power strokes.

The commercial gas engine of to-day has a single acting cylinder. The difficulties of packing against the high temperatures has been found, and probably will remain, insurmountable. French engineers have sought in vain, through long continued and expensive experiments, to find methods of packing a piston rod against the high temperatures of the cylinder, and thus to produce a double acting gas engine. The American engineers have heretofore tried, but thus far have failed, to produce a double acting gas engine.

The most successful practice in gas engines has been followed in producing the engine illustrated herewith, that is, single acting combustion cylinders are used which are placed opposite to each other and form a single mechanical element. Midway between them is a cylinder of larger bore performing the office of a pump for transferring the mixtures to their proper destination before combustion. The compound piston, which reciprocates in these three cylinders, is also a single mechanical element, the two ends of similar size forming plunger pistons, operating in the combustion cylinders, in the middle of which is an annular enlargement *D* which fits the larger bore of the pump cylinder. The deferential area so produced between the combustion piston and the pump cylinder is the area which is available for transferring the gases, and forms the piston area of the pump cylinder. It is to this element, namely, the annular shaped pump piston, that the main piston rods, two upon each side, are attached, as may be seen in Fig. 1, thereby eliminating the necessity of packing against the high temperatures; the only packing required in the piston rods is against the low pressures of the cold mixture within the pump. It will be seen by Fig. 2 that the two combustion cylinders *AA* are at opposite ends of the compound cylinder. The water jackets are shown at *F*. Along parallel to the front cylinder are the cored passages *G*, in which the two piston rods *E*, connecting with the cross head, reciprocate (see Fig. 1). The packing glands *I* are required to pack only against the small pressures of the gases in the pump cylinder. This pressure is so slight as to be wholly disregarded.

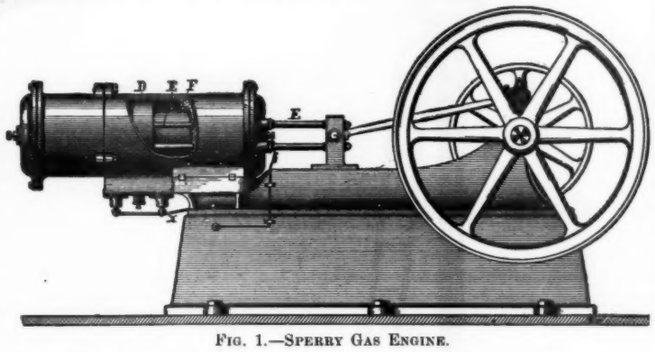


FIG. 1.—SPERRY GAS ENGINE.

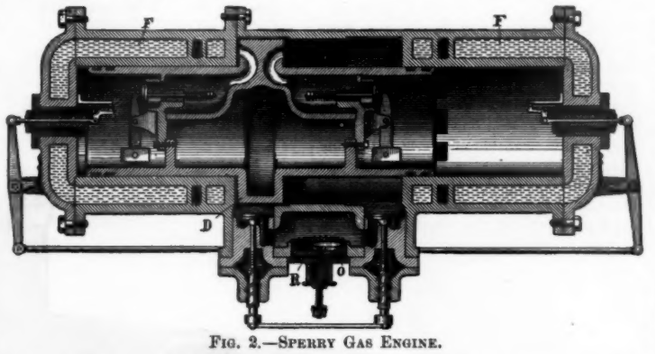


FIG. 2.—SPERRY GAS ENGINE.

The law of operation or cycle of the engine is as follows: The pump is double acting and is provided at either end with an induction valve, below which is a screw, by turning which the seating of the induction valve may be varied. This varies the pressure within the pump, and, therefore, the amount of mixture transferred into the combustion cylinder previous to ignition. The ignition is performed by the electric spark, the two igniters being coupled in multiple arc. The mixing device is peculiar, extremely simple, and consists of a valve *O* covering both gas and air passages in a perforated plate. This valve is so large as to nearly fill the circular space in which it is contained, leaving only a very narrow circular slot at its peripherys. The gas and air as they are drawn through this narrow slot are given a very high velocity by the suction of the pump at either end. A wire gauze diaphragm *R* stands immediately in front of this passage and completely breaks up the rushing gases as they emerge from the slot. These as they reunite form a most intimate and complete mixture. Experiment has shown that this mixture attains almost theoretical perfection, aiding materially in the perfection of combustion and economy attending the operation of the engine. The compression of the engine is from 35 to 45 pounds before ignition, when the engine is working near its capacity, and from this figure down to atmospheric compression, when working less than its rated capacity. A governor on the axle is connected by rod *X* to the two screws beneath the induction valves, and thereby automatic regulation is obtained, which is found in practice to hold the engine within three per cent. from full load to zero.

The actual performance of the engine is very high, being from 19 to 21 cubic feet per horse-power. The perfect uniformity of speed is owing to the fact that every stroke is effective, and a comparatively small weight of engine is required to the horse-power. Chief among its merits is its low cost of manufacture.

A 13 horse-power engine of this make weighs only about 1,900 pounds and requires but a small flywheel, and for purposes of driving dynamos the flywheel may be used for band wheel, about the same practice being followed as in steam engineering in determining the weights of these elements.

The engineering department of the Patent Office looked upon this invention with unusual interest owing to the fact of its being the first system of construction which rendered the double acting gas engine feasible, and a patent containing some 65 claims was granted upon the same.

Does Advertising Pay?

Standing beside a manufacturer, engaged in introducing a new article, who was scanning his list of advertising contracts for the year, we asked, pointing to a certain journal: "Does advertising in such journals pay?" In reply he said: "I don't know. I can't point to any advertisement and trace out actual results, but this much I do know, that our sales in March, 1888, were more than double what they were in March, 1887, and in March, 1889, they were double what they were during the same month in 1888. As we look over our salesbooks we note an increased business every month, and when we see this record we are satisfied to pay the large sum we do annually for advertising, without endeavoring to trace out details. We glean in all fields and sow beside all waters, and then look for results."—*Ex.*

ELECTRIC LIGHT NEWS

—— At a special meeting of the stockholders of the Brooklyn Edison Electric Illuminating Company, held last week, the capital stock was increased from $600,000 to $1,500,000.

—— The Carpenter Electric Light and Power Company, of Catlettsburg, Ky., is installing a 600-light Continental incandescent dynamo and a 70 horse-power Buckeye engine.

—— One of the arc lights in Stoneham, Mass., is situated on the top of a pole which is lashed to a tree and is 106 feet from the ground. This light is probably one of the highest in that part of the country.

—— The stockholders of the United Electric Light and Power Company, of New York city, have filed a consent in the County Clerk's office for the execution of a mortgage on the property of the company, not to exceed $5,000,000.

—— Whether we shall ever be able to see our friends at a distance, as we now talk with them, is exceedingly problematical; but if we ever do so, it will doubtless be through the mysterious connection between light, electricity and the element selenium.—*Popular Science News.*

—— The Rutland, Vt., Electric Light Company has placed in its station an automatic switch, by which, in case of an accident or break to a wire on any circuit, the current is prevented from passing out of the station. With this automatic arrangement it is said to be possible to handle the wires with perfect safety.

—— Prof. J. H. Barrett, city electrician of Chicago, returned from his vacation last week, and is again on duty. "In my visits to the East," said he, to a local reporter, "I tried to find something to improve on in our system of police and fire alarm telegraph, but I could not do it. I found in every city great interest manifested in our system of electric lighting, and I have been asked to give details as to success, cost of maintenance, cost of plant, etc. I am going to get up a circular letter giving all the facts in detail, which I will have ready in about a month."

—— The subject of the proper insulation of electric wires is attracting much attention among fire insurance men in Seattle. The members of the New England Insurance Exchange are now on a tour of the country looking into the observance of rules of the board of underwriters, and are now in St. Paul on their way to the Coast. Mr. Barton, manager of this body, stated to a Seattle electrician that the subject of imperfect insulation was being agitated at San Francisco, and that the underwriters would cancel all risks on buildings where the rules in regard to insulation of wires were disregarded.

—— The Newark Electric Light & Power Company, of Newark, N. J., has been operating the Westinghouse system of alternating current electric lighting for more than a year. In all this time the service of the company has been of such a character as to constantly grow in public favor. As a natural result of this fact, the company is now obliged to make extensive additions to its plant. When the plant was first operated, 2,250 incandescent lamps seemed to be sufficient to supply all demands. However, the superiority of electric lighting over any other illuminant has since been demonstrated so largely that to-day the plant has to be more than doubled. The contract for 3,000 lights was awarded the Westinghouse Electric and Manufacturing Company a few days ago, and the apparatus is to be installed immediately.

The Hall Electric Railroad Signal.

This signal is constructed and operated as follows: The first wheel entering a block section sets the signal at danger and breaks an electric circuit so that the signal cannot show safety until the train passes out of the block section and operates the track instrument which restores the circuit. If any electrical fault occurs, the signal goes to danger. The signal is held at safety by electro-magnetism. If for any cause this power is withdrawn, the signal immediately assumes the danger position by the force of gravity. It can only again take the safety position when all the apparatus is in normal working order.

The signal instrument is shown in Fig. 3. A white reflector in the case is exposed through the glass-covered aperture as long as a red disk is held out of sight. As the front of the case is dark, the indication of safety is shown by a white disk in the midst of a dark ground. The falling of the signal disk before the glass produces the danger signal. During the day, the lamp for use at night hangs below the glass. The operating mechanism of the signal instrument consists of a two-winged armature revolving on a shaft between the prolonged cores of an electro-magnet and the signal disk and its counterweight, which are attached to the armature. The disk being heavier than the counterweight, the signal moves to danger by gravity. When the electro-magnet is energized the disk is drawn up out of sight by the rotary movement of the armature.

The track instrument for operating the signal is shown in Fig. 1. The wheel passing over the end of the lever operates a piston inside the column which makes an electric circuit. The piston works in a closed chamber and is protected from shock by the air cushion which is formed when the lever is operated. The lever is confined between two rubber springs which are so graduated that the pressure imposed by any weight less than that offered by any ordinary car wheel, fails to operate the piston.

In Fig. 2 is shown the switch instrument. When the switch is set for the main line, the pendulum of the instrument is at right angles with the rod extending to the rail, and a spring in the head of the standard is held in contact with an anvil. This completes the electric circuit, which holds the signal at safety. Any movement of the switch from the main line throws the pendulum from its vertical position, the spring is released from contact with the anvil, the circuit is broken and the signal falls to danger.

In Figs. 4 and 5 are shown the automatic highway crossing signal and bell. By a simple arrangement of interlocking instruments (Fig. 6) and track instruments, the bell is made to ring by the approach of a train from either direction on a single track; the track instrument, which would cause a false signal by being operated by a train moving away from the crossing instead of towards it, being automatically cut out.

This system of signals, of which the above is a very brief description, is manufactured by the Hall Signal Company, 50 Broadway, New York. It is in daily operation on a number of prominent railroads and has been strongly endorsed by leading railroad men.

Electricity and Gas.

At the half-yearly meeting of the Liverpool United Gas Light Company, on the 19th inst., Mr. Edward Lawrence, the president, said that, so far as the application and use of electricity went, he saw nothing up to the present time to cause uneasiness to the proprietors of the gas stock. It was quite true the consumption of electricity in Liverpool was increasing, but at the same time the consumption of gas had increased by two per cent. He thought that they might safely conclude that, with other uses being found for gas, the consumption would continue to be extended, while the use of electricity would also be increased.—*London Weekly Bulletin.*

You can find nuns in a nunnery, but don't look for bats in a battery.

Municipal Lighting.

Last Spring, it will be remembered, the Supreme Court, in response to a request from the House of Representatives, gave a unanimous opinion in favor of the constitutionality of a proposed law permitting cities and towns to manufacture gas and electricity, and supply their inhabitants with the same. The Senate, however, killed the bill, which had passed the House by an enormous majority. But the court's opinion was so strongly in behalf of the right of municipalities to assume functions administering to the necessity or general convenience of their people, that it was felt by many that cities and towns might, without waiting for legislative authority, proceed to supply their inhabitants with gas or electricity. The recent action of the town of Peabody promises to bring this question to a test. As it is, the municipalities of this State have the right to manufacture gas or electricity for their own use in the lighting of streets and public buildings. The town of Danvers has had its own electric lighting plant for something like two years, and now its next door neighbor, Peabody, has decided to put in its own plant, also. But the significant thing in the case of Peabody is, that it is announced that the town will sell, for commercial purposes, any surplus lighting power it may have. Its right to furnish light to private parties will, of course, be hotly contested by private electric lighting and gas interests.

The loophole furnished by the question of the disposal of surplus product is so large that it would not be suprising if it gave to cities and towns all the latitude desired in the matter. The precedents existing are very numerous. Municipalities are continually selling surplus products of various kinds, and the receipts for these are frequent items in their accounts. Cities and towns, for instance, very often sell to private parties gravel from their gravel pits, maintained for the construction and repair of highways, and when their public teams are not in use they employ them in doing work for private parties when opportunity offers. The interests of economic administration demand that all surplus be disposed of to the best advantage. It would be remarkable should a line be drawn at surplus electricity at this late day.

There is an important Supreme Court decision that will be likely to have a bearing on this question. It is that delivered by one of the most eminent of Massachusetts jurists, Chief Justice Shaw, in the Lowell market house case. The right of the city to build a market house was contested, and it was further claimed that, even if the right existed, the building of that particular market house was illegal, for it was much larger than was required for market purposes, and the second story of the building was devoted to other uses. Upon this the decision was given that not only was the building of a market house a proper function for a city or town, but that so long as the main purpose of the edifice was a market house, it made no difference if it was larger than was needed, and the court held, in substance, that the size of the building and the purposes to which the rest of it might be put were matters properly to be left to the discretion of the municipality. On these lines it would be logical to hold that a municipality having the right to establish a gas or electric plant for public lighting, the size of the plant was a matter to be left to its own discretion, as well as the disposal that might be made of the surplus product, so long as the main purpose of the plant was that of public use.

The outcome of this case will be awaited with interest. Nevertheless, should the right of municipalities to engage in commercial lighting thus be assured, legislation on the subject will probably still be desirable in order to define and systematize the manner in which it may be done.—*Boston Herald.*

FIG. 3.—SIGNAL INSTRUMENT, HALL SIGNAL COMPANY.

FIG. 4.—HIGHWAY CROSSING SIGNAL, HALL SIGNAL COMPANY.

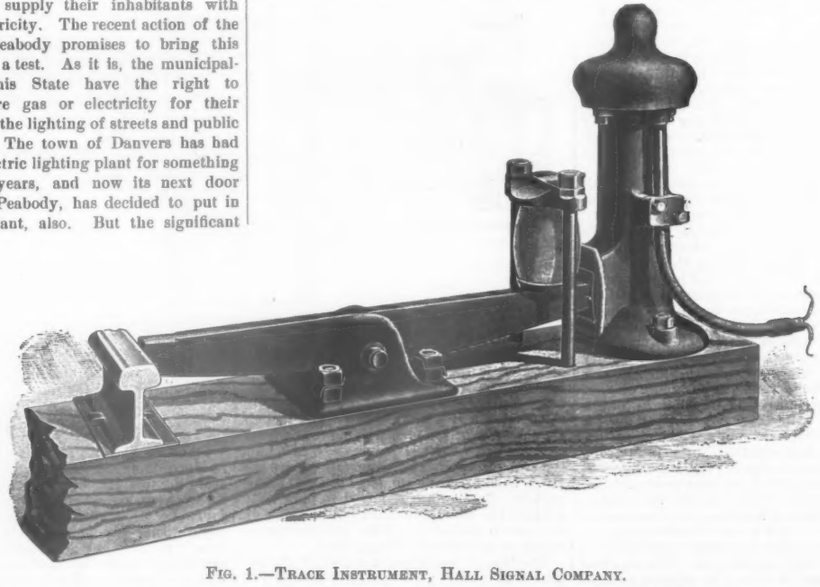


FIG. 1.—TRACK INSTRUMENT, HALL SIGNAL COMPANY.

Frankland's Researches on the Chemistry of Storage Batteries.

The chemical changes which take place during the charging and discharging of storage batteries have been the subject of considerable difference of opinion amongst chemists and physicists. Some authorities, says our London namesake, have maintained that the effects are dependent on the occlusion of oxygen and hydrogen gases on the plates, whilst others, regarding the question from another point of view, have held that lead sulphate plays an important part in the phenomena. That the differences of opinion amongst experts have been widely divergent may be recognized from the fact that scientists, who, apparently, are well competent to express their views, have asserted that no chemical change of the lead sulphate occurs either in the charging or discharging of the plates.

In order to test the accuracy of the former opinion, Dr. Frankland, some time ago, undertook a series of experiments, the results of which were communicated to the Royal Society, in London. Two plates of lead were twisted into a corkscrew form, the gutter of the screw being filled with red lead; these plates were immersed in dilute sulphuric acid and charged in the usual way. When these plates were subsequently heated and the gas evolved, collected and examined, it was found that mere traces of oxygen and hydrogen were expelled, whereas, if the theory had been correct, there should have been a copious evolution. Hence, it was concluded that the important agent in the cell is not constituted by the occluded gases.

With regard to the lead sulphate, Dr. Frankland observed that in charging a strong cell a considerable amount of sulphuric acid disappears, and is accompanied by a certain deposition of lead sulphate, but that the deposit formed is inadequate to account for the total acid which has disappeared.

The strength of the acid ceases to diminish and afterwards increases as the charging of the cell proceeds; this change continues until the maximum charge has been reached, and oxygen and hydrogen gases are evolved from the positive and negative plates, respectively.

When the cell is discharged, the phenomena above described are reversed, the specific gravity of the acid decreasing from the point from which it began to increase on the charging of the cell.

From these experiments and the observations made upon them, Dr. Frankland deduced the following results, representing the changes which occur in *charging* a storage battery, viz:

1. The electrolysis of hexabasic sulphuric acid (*i. e.*, H_6SO_6) according to the equation

$$H_6SO_6 = \underbrace{SO_3 + 3O}_{\text{on + plate}} + \underbrace{3H_2}_{\text{on - plate}}$$

2. The reconversion of the evolved sulphuric anhydride (SO_3) into the corresponding acid (H_2SO_4).

3. Chemical action on the coating of the positive plate according to the equation

$$PbSO_4 + O + 3H_2O = PbO_2 + H_6SO_6.$$

4. Chemical action on the coating of the negative plate according to the equation

$$PbSO_4 + H_2 + 2H_2O = Pb + H_6SO_6.$$

When the storage battery is *discharged*, the first two changes observed in charging the battery are repeated. Further, on the coating of the positive, formerly the negative electrode, the chemical change which takes place is represented by the equation

$$PbO_2 + H_2 = PbO + H_2O$$

on the coating of the negative. Finally, the positive electrode, the change occurring is represented by the equation

$$Pb + O + H_6SO_6 = PbSO_4 + 3H_2O.$$

Hence, Dr. Frankland formed the opinion that the formation of the cell consists in the more or less thorough decomposition of those portions of the lead sulphate comparatively removed from the conducting metallic nucleus of the lead. Lead sulphate possesses a low specific conducting power, whilst lead peroxide, and especially spongy lead, offer comparatively little resistance to the current, which is thus enabled to bring the outlying portions of the coating under its influence.

Since these results were published, Dr. Frankland has been pursuing his researches in the same direction. He undertook a series of experiments, with a view to ascertaining what lead compounds actually take part in the chemical reaction, in charging and then discharging secondary batteries.

A quantity of lead oxide (PbO_2), reduced to a fine powder, was treated successively with portions of dilute sulphuric acid until the liquid became permanently acid. On being allowed to stand, a buff colored precipitate separated from the mixture and was found by analysis to possess the formula $Pb_5S_3O_{14}$.

When finely powdered red lead (Pb_3O_4) was treated in the same way with dilute sulphuric acid, the powder which settled on standing was brownish-red in color, and was found on analysis to have the constitution $Pb_5S_2O_{10}$.

Dr. Frankland considers that these hitherto unknown or undescribed salts constitute the original active material of storage cells, and that the following equations accurately represent the reactions which take place on the surface of the plates on charging and discharging the battery:

FIG. 2.—SWITCH INSTRUMENT, HALL SIGNAL COMPANY.

A. If the buff-colored salt is the active material used, then

I. On charging—

(1) Positive plate, $Pb_5S_3O_{14} + 3H_2O + 5O = 5PbO_2 + 3H_2SO_4$.

(2) Negative plate, $Pb_5S_3O_{14} + 5H_2O = 5Pb + 3H_2SO_4 + 2H_2O$.

II. On discharging—

(1) Positive plate, $5PbO_2 + 3H_2SO_4 + 5H_2 = Pb_5S_3O_{14} + 8H_2O$.

(2) Negative plate, $5Pb + 3H_2SO_4 + 5O = Pb_5S_3O_{14} + 3H_2O$.

B. If the brownish-red colored salt is the active material used, then

I. On charging—

(1) Positive plate, $2Pb_5S_2O_{10} + 2O_2 + 4H_2O = 6PbO_2 + 4H_2SO_4$.

(2) Negative plate, $Pb_5S_2O_{10} + 4H_2 = 3Pb + 2H_2SO_4 + 2H_2O$.

II. On discharging—

(1) Positive plate $6PbO_2 + 4H_2SO_4 + H_2 = 2Pb_5S_2O_{10} + 8H_2O$.

(2) Negative plate, $3Pb + 2H_2SO_4 + 2O_2 = Pb_5S_2O_{10} + 2H_2O$.

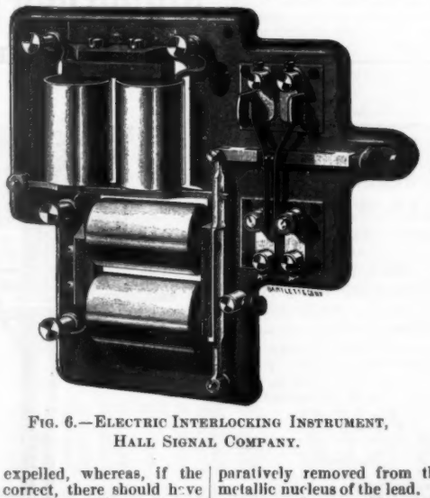


FIG. 6.—ELECTRIC INTERLOCKING INSTRUMENT, HALL SIGNAL COMPANY.

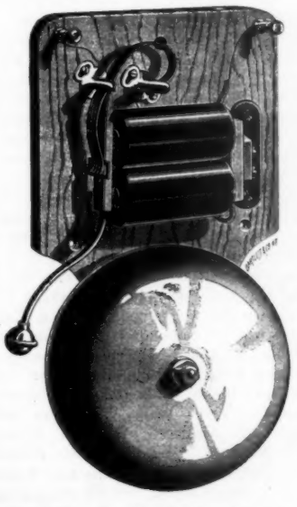


FIG. 5.—SIGNAL BELL, HALL SIGNAL COMPANY.

It is worthy of remark that in practice only half as much material seems to be necessary for the negative as for the positive plates, and this is evidence in favor of the latter alternative, B, being correct.

We cannot assume, however, that there is nothing more to be discovered concerning the chemical action of storage batteries. The subject is full of complications, and it is to be hoped that electricians will receive further and large assistance from chemists who alone, perhaps, are able to throw the necessary light upon these obscure matters.

Telegraphers' Blunders.

Considering the noise of New York's great room, and the fact that the operators have to jump from theology to stocks, often sending off long reports upon subjects of which they know nothing, it is surprising that the blunders are so few, writes the New York correspondent of the Charleston *News*. The most amusing of such errors seem to be due not to carelessness or inattention, but to similarity of certain letters in the telegraphic alphabet, and to the inability of the receiver to write down as fast as the instrument clicks out its message.

There are very good reasons, no doubt, for many of the mistakes recorded against telegraph operators. There are no excuses for others. Some are the result of sheer stupidity, ignorant operators being put at work requiring not alone skill in manipulating a key, but intelligence behind all. The operator who reads hearse for horse may have had his copy written by the same reporter who dashed off a criticism on "Girofle Girofla," and who was dumfounded to find that the telegraph made it "Sniffle Snoffle." Yet it does not always follow that this is the case, for a telegram has been known to be transmitted "Yes" when the copy made it "No" with copperplate distinctness. One of the most curious blunders I remember occurred over a cable circuit of the Associated Press, the message as received being as follows:

LONDON, March 25.—Two Americans were arrested here to day for attempting to shave the queen.

The message gave the names of the persons, together with other details, but nothing in it accounted for the extraordinary statement that the men had attempted to "shave the queen." No one in the office where the dispatch was received could understand why any Americans should undertake such an unheard-of feat, or why the queen should need shaving. The more the telegram was read the more perplexing it grew, until at last it was decided to ask for explanations from the other side of the water. Very promptly the operator on the other side sent back the correction that the Americans referred to had been arrested for "attempting to shove the queer."

"Yes, indeed. Send horse and carriage to depot." was the innocent message which went to a lady in Utica from the city not long ago. She was married, and her husband, usually called Joe, had been away from home for several weeks. The wife had telegraphed a lady member of the family to come up and spend a few weeks with her, and the answer was sent as above. The Utica lady was prostrated with grief when she received a dispatch reading: "Joe is dead. Send hearse and carriage to depot." Arrangements were made in a hurry, and the hearse and carriage were in waiting when Joe and the lady stepped out of the train.

Long circuits and weak electrical currents frequently play the mischief with dots and dashes. They "fall out," as the operators say, vanish or mingle until two or three letters are mixed together. So many telegrams are sent in cipher, or according to a code, that the receiver does not hesitate to write down the most absurd nonsense if he thinks that the sender intends it. Thus the simple message, "Come home; James is not well," has been metamorphosed into "Coghog; Jags is not 100." The receiving operator probably committed the old error of reading (by sound) g for me, the signs for which are quite similar, while "well," if not carefully read, is liable to be transformed into 100. It must have been the same telegrapher who transformed John Howard Payne's beautiful lines into "Hog, swot hog, there's no place like hog."

The National Conduit Company has closed a contract with the Field Engineering Company to supply the conduit for the subways for the Buffalo Electric Street Railway. This is a very large and important order, and, as it is the first of the kind used for electric railway work, will be watched with great interest.

KINDRED INTERESTS

The Kansas Electric Company has removed to 110 East Seventh street, Topeka, Kan.

Perry & Bemis, Indianapolis, Ind., have secured the State agency for the Consolidated Electric Storage Company's secondary battery.

The American Circular Loom Company, Boston, has issued a pocket price list of its patent woven wires and cables. A number of tests of the wire are given in this little book, the results of which show that the insulation is not easily abraded.

The "C. & C." Electric Motor Company has installed an electric organ-blowing equipment in the First Presbyterian Church, in Brooklyn. It is said that 42 other churches over there are considering the advisability of having their organ pumps operated by electric motors.

"There is only one objection I have to the Pennsylvania Railroad," said a well-known electrical man, recently. "The tracks are so smooth that I can't determine the speed of the train I am on by counting the clicks of the wheels over the rail joints, as I generally do on other roads."

Mr. Eugene F. Phillips, in addition to his already large factories at Providence, R. I., and Montreal, Canada, is building an addition to his Providence factory. The new part will be 200x40 feet and six stories high. This enlargement is necessitated by the great and steadily increasing demand for the many brands of wire produced at these well-known factories.

A few weeks ago, in describing and illustrating the large Chicago house of the Great Western Electric Supply Company, our cut showed one of the novel elkhead electroliers made by this firm. This is now one of the electrical features at the Chicago Exposition. The firm has recently received 19 mounted deerheads from the Yellowstone National Park, which will also be made into electroliers.

The Thomson-Houston Motor Company is erecting a large electrical plant for the Atchison, Topeka and Santa Fe Railway Company, at the Castle Gate mine in Utah. The generating plant will have a capacity of 750 horse-power, and the first application will be as follows: A 35 horse-power motor will be connected with a hoisting engine, and will be employed to hoist empty mine cars, 16 in a trip, up a grade of from 5 per cent. to 20 per cent. into the mine. A similar motor will be attached to the large ventilating fan, and the main haulage roads will be illuminated by incandescent lamps; there will also be 25 arc lights on the surface to furnish light on the tipple and for other outside work.

The Sprague Motor Company took a contract to furnish and equip an electric road for Mr. D. C. Robinson, of Elmira. The work was commenced Monday, August 25th, and completed during the night of August 31st. Three miles of track laid, wires strung, six motors put in operation, and everything completed in the seven days. In the first week after starting, the road carried over 85,000 passengers to and from the Inter-State Fair. The work was in charge of C. H. Bloomer and I. Hibler, of the Sprague Company; F. A. Cheney represented D. C. Robinson. The general opinion was that the work could not possibly be done in the time set. But the combination of Robinson, Cheney and the Sprague Company was a success.

The Westinghouse Electric and Manufacturing Company has just obtained the contract from the Citizens' Electric Light and Power Company, of Blairsville, Pa., to light up that town. The contract was secured under the severest kind of competition, in fact, there is not a company in the country which did not bid upon it, and the fact that the contract was given to the Westinghouse Company speaks volumes for their alternate current system, especially because the Westinghouse people entered the contest with the second highest figure. In order to assure themselves that the company would get the best system of electric lighting, a committee of seven was appointed with a view of making a personal investigation in several towns and cities where electric lights are now in use. This committee traveled to Altoona, Elizabeth, Tarentum, Allegheny and Pittsburgh, Pa. What they saw evidently convinced them that the Westinghouse system suited their purpose and the contract was made. The plant will start with a capacity of 750 incandescent and 40 arc lights, but the company expects to increase this almost immediately.

The Thomson-Houston Electric Company has been awarded the contract for furnishing an electric light plant for the United States cruiser "Newark." The plant will consist of three sets of dynamos and engines, each dynamo being directly connected and secured to the same bed plate as the engine driving it. The dynamos will be compound wound, and will be run at a speed of 400 revolutions per minute. They will have a capacity of 200 amperes at 80 volts pressure, and the specifications call for an efficiency of not less than 80 per cent. at full load. The insulation resistance of the entire system, including the circuits of the dynamos, must not be less than 100,000 ohms. The incandescent lamps are to be of 10, 16, 32 and 50 candle-power, placed at various parts of the ship, the total number of lamps being 425. The ship is also to be furnished with four Mangin projectors of the latest type, each supplied with two combination lamps. This company has also been awarded the contract for an electric light plant at the Mare Island (Cal.) Navy Yard for $44,900. This is considered a very reasonable figure, and will leave the department with enough to begin the projected plans at the New York and Norfolk yards. It is part of a general plan with contemplated electric plants for four navy yards.

The Ball Engine Company, Erie, Pa., state that their shop is crowded with orders, they having, at the present time, orders for 10,000 horse-power, largely compounds. Among their orders are the following: Rochester Street Railway Co., Rochester, N. Y., three 300 horse-power triple expansion; Rochester Street Railway Co., Rochester, N. Y., three 150 standard; Rochester Street Railway Co., Rochester, N. Y., one 60 standard; Buffalo Street Railway Co., Buffalo, N. Y., six 300 double compound; Southern Railway Co., St. Louis, Mo., five 150 standard compound; Edison Electric Illuminating Co., Brooklyn, N. Y., three 250 double compound; Newark Electric Light and Power Co., Newark, N. J., two 250 double compound; Harlan & Hollingsworth, Wilmington, Del., one 150 and one 100 standard; Central Passenger Railway Co., Louisville, Ky., three 150 standard; Walla Walla Gas and Electric Light Co., Walla Walla, Wash., one 100 compound; American Waltham Watch Co., Waltham, Mass., one 300 double compound; Naugatuck Electric Light Co., Naugatuck, Conn., two 100 compound; Schuylkill Electric Railway Co., Pottsville, Pa., one 150 standard; Columbia Electric Light Co., Philadelphia, Pa., two 100 standard compound; M. J. Shields & Co., Moscow, Idaho, one 60 standard compound; Essex Street Railway Co., Salem, Mass., one 100 standard and one 100 standard compound; Amsterdam Street Railway Co., Amsterdam, N. Y., one 125 standard; North West Electric Supply and Construction Co., Seattle, Wash., four 35 standard; North West Electric Supply and Construction Co., Seattle, Wash., one 150 standard; City Gas Light Co., Norfolk, Va., one 125 standard.

PATENT PERFORATED

Electric Leather Belting

MANUFACTURED BY

Charles A. Schieren & Co.,

45, 47, 49, 51 FERRY ST.,

COR. CLIFF ST.

BRANCHES:

BOSTON, 119 HIGH STREET.
PHILADELPHIA, 226 NORTH 3d STREET.
CHICAGO, 46 SOUTH CANAL STREET.

WASHINGTON CARDS OF INTEREST TO ELECTRICAL MEN.

The Columbia National Bank,

911 F STREET, N. W.,

WASHINGTON, D. C.

A General Banking Business Transacted.

CAPITAL, $250,000.

B. H. WARNER, *Prest.* A. T. BRITTON, *Vice-Prest.*
E. S. PARKER, *Cashier.*

THE

WASHINGTON LOAN AND TRUST CO.,

Temporary Offices, 1001 F Street, N. W.

LOANS MONEY on COLLATERAL and REAL ESTATE.

Pays Interest on Deposits. Has for sale Secured Investments.

CAPITAL, - - - - - - $1,000,000

CALL AND SEE OR WRITE TO US.

B. H. WARNER, *Prest.* W. B. ROBISON, *Secretary.*
JNO. JOY EDSON, *V.-Prest.* W. B. GURLEY, *Act'g Treas.*

Washington Electric Conduit Co.,

Room 36, Corcoran Building,

Washington, D. C.

Manufacturers and constructors of glazed Terra Cotta conduits for electric wires of all descriptions. Approved by the engineers of the District of Columbia and local companies. Can be examined by interested parties.

INVENTORS

Coming to Washington to further any electrical patents, will profit by calling on **C. W. Messner, of 1225 F St., N. W.** All the appliances necessary for tests, experiments, etc. Also, Electrical Contractor and Constructor. Special attention to isolated plants. Agent for the "C. & C." electric motor—sizes, ⅛ to 50 horse-power. The only electric motor on the market to-day.

TRAVELING MEN SELLING TO HARDWARE Plumbers, Steam and Gas Fitters, can secure a good side line by addressing Manufacturer, 1448 Niagara St., Buffalo, N Y.

F. Z. MAGUIRE,

ELECTRICAL SECURITIES, ETC.,

18 WALL STREET,

NEW YORK.

ELECTRIC AND STREET RAILWAY PROPERTIES BOUGHT AND SOLD.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire, Electrical Securities, 18 Wall street, N. Y., Thursday, September 11, 1890. New York, Boston and Washington Stock Exchanges.

NEW YORK.	
Western Union Telegraph Co.	82⅞.
Edison General Electric Co.	99.
" " " Deferred	90.
Consolidated Electric Light	
Edison Electric Illuminating Co.	
United States Electric Light	35.
BOSTON.	
Thomson-Houston Electric Co.	50.
" " " Preferred	95⅛
" " " Series C	12.
" " " Series D	5¾.
" " International	
" " Welding Co.	
" " European Welding Co.	80.
Westinghouse	37¾.
Ft. Wayne Electric Co	11½.
TELEPHONE:	
American Bell	224.
Erie	48.
New England	51.
Mexican	80.
Tropical American	
MISCELLANEOUS:	
Edison Phonograph Doll	1¾.
WASHINGTON.	
Pennsylvania Telephone	25.
Chesapeake and Potomac	68.
American Graphophone	16.
United States Electric Light (Washington)	103.
Eckington and Soldiers' Home Railway	68.
Georgetown and Tennallytown	52.

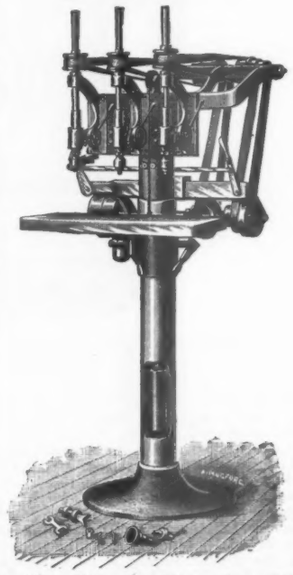
ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON SEPTEMBER 9, 1890.

435,958 Method of regulating electrically operated mechanism; Merle J. Wightman, Lynn, Mass., assignor to the Thomson-Houston Electric Co., of Connecticut.
435,964 Electrical amusement reporting apparatus; Melvin D. Compton, Newark, N. J.
435,967 Electric lamp; Wm. D. Graves, Cleveland, Ohio, assignor of one-half to Frank J. Stafford, same place.
435,982 Regulator for dynamo-electric machines, Wm. Stanley, Jr., Great Barrington, Mass.
435,983 Electrical traction apparatus; William Stephens, Santa Rosa, Cal.
435,985 Rheostat; Frank Thone, Oskaloosa, assignor to the Hawkeye Electric Manufacturing Co., Davenport, Iowa.
436,001 Electrolyte for galvanic batteries; Frank K. Irving and Frederick M. Hill, Brooklyn, assignors of one-third to Theodore W. Bayaud, New York, N. Y.
436,023 Electric detonator or primer; Henry J. Smith, Pompton, N. J.
436,025 Electric signal for railways; Geo. A. Tower, Richmond, Va.
436,030 Electric burglar or automatic fire alarm; Edmund R. Wilder, Kansas City, Mo.
436,050 Secondary battery plate; Thomas P. Whittier, Saginaw, Mich.
436,067 Cut-out for electrical translating devices
436,107 Electric switch; Chas. G. Perkins, Hartford Conn.
436,113 Magneto-electric machine; La Motte C. Atwood, St. Louis, Mo., assignor to the Atwood Electric Co., same place.
436,119 Electric soldering iron; Chas. E. Carpenter, Minneapolis, Minn., assignor to the Carpenter-Nevens Electro-Heating Co., same place.
436,122 Double-pole snap-switch; Howard H. Crowell, Syracuse, N. Y.
436,125 Electric lighting and heating apparatus for electric railways; Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place.
436,127 Electric motor; Thos. A. Edison, Llewellyn Park, N. J.
436,148 Steam dynamo electric machine; Edw. C. Newton, Little Rock, Ark.
436,154 Electric signal for railroads; Frank C. Schroen, Baltimore, Md.
436,168 Electric danger and safety signal for railroads; Edw. M. Bent, Paris, Ill.
436,200 Electric converter; Geo. Westinghouse, Jr., Pittsburgh, Pa.
436,219 Electric valve controller; Harry W. Deeds, Indianapolis, Ind.
436,225 Insulator; Josiah C. Firth, Auckland, New Zealand.
436,238 Lightning arrester; Geo. D. Hoop, Jackson, Ohio.
436,275 Pulsating current battery system. 436,276 Adjustable current reciprocating engine system.
436,277 Electric power hammer; Chas. J. Van Depoele, Lynn, Mass.
436,281 Portelectric; John T. Williams, Mount Vernon, N. Y.

Sigourney Drills.

IMPROVED.



Sensitive, Strong and Interchangeable. One, Two and Three Spindles.

GUARANTEED PERFECT.

Send for Price List "B."

The Sigourney Tool Co.,

HARTFORD, CONN.

Daniel W. Baker. Cyrus O. Baker, Jr.

BAKER & CO.,
Importers, Melters and Refiners of

PLATINUM,

408, 410, 412 and 414 N. J. R.R. Ave., NEWARK, N. J.

Platinum in sheet and wire, all sizes, and any degree of hardness. Scrap and native platinum purchased

Fuse Wire! Fuse Wire!

Accurately Determined. Carefully Made by a new Process. For Sale by

W. H. GORDON & CO.,
ELECTRIC LIGHT AND POWER SPECIALTIES,
Send for Catalogue. 115 BROADWAY, NEW YORK.

Shultz Belting Company,
MANUFACTURERS OF
SHULTZ PATENT FULLED LEATHER BELTING AND LACE LEATHER
Office and Factory: Cor. Bismarck and Barton Sts., St. Louis, Mo.

Our Belting is made of leather tanned on the surface only; the interior (which is the fiber and strength of the hide) is not tanned but rawhide fulled and softened by our patent process. Our Belting is more pliable, hugs the pulley better, transmits more power than any other, and is the only perfect ELECTRIC LIGHT BELT MADE. Agents in all cities. Send for trial belt.

ELECTRICAL MEASUREMENT
Instruments and Batteries of the Very Highest Grade.
Precision and Constancy, Quality and Finish the Best in the World.
Catalogue of Standard Test Instruments furnished upon application.
THE E. S. GREELEY & CO.,
5 AND 7 DEY ST., NEW YORK.

W. R. OSTRANDER & CO.
195 & 197 FULTON ST., NEW YORK.
Manufacturers of
SPEAKING TUBES, WHISTLES, ANNUNCIATORS, Electric and Mechanical Bells.
FACTORY,
De Kalb Ave.,
BROOKLYN.
Send for Illustrated Catalogue.

STANDARD ELECTRIC TEST INSTRUMENTS.

AMMETERS AND VOLTMETERS FOR DIRECT AND ALTERNATING CURRENTS.

QUEEN'S NEW Portable Combination Testing Set, WITH GALVANOMETER.

WE PAY SPECIAL ATTENTION TO RECALIBRATING AMMETERS AND VOLTMETERS.
SEND FOR CATALOGUE I-66 OF ELECTRIC TEST INSTRUMENTS.
QUEEN & CO., - Philadelphia, Pa.

SEND FOR CATALOGUE.

THE WYCKOFF PIPE CO.,
MANUFACTURERS OF
WOODEN PIPES FOR
UNDERGROUND ELECTRICAL WIRES.
We have large works for creosoting Lumber, R. R. Ties, Telegraph Poles, &c., &c.
WILLIAMSPORT, PENN.

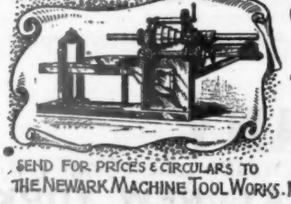
THE LEHIGH VALLEY
CREOSOTING CO.
WORKS, PERTH AMBOY, N. J.
Office, Foot of Washington Street, JERSEY CITY, N. J.
Creosoted Lumber, Underground Conduits, Telegraph Poles, Piling and Ties Furnished.

HYDRAULIC PRESSES.
ALL VARIETIES.
PUMPS, VALVES, GAUGES AND FITTINGS, PUNCHES, SHEARS, BUFFING MACHINERY, &c.
WATSON & STILLMAN,
210 EAST 43D STREET, NEW YORK CITY.
Special Attention to Electrical Work.

SILKS.
Full assortment of different sizes and qualities on **BRAIDER SPOOLS,** ready for the machines, in Red, Yellow and Green. Other colors to order. **Send for Sample and Prices.**
WM. MACFARLANE, & CO., 81 Grand Street, New York.
Telephone No. 971 Spring. Mill, Bergen Point, N. J.

THE CLARK ARC LIGHTING SYSTEM
Is the Safest and Most Economical in the United States.
Manufactured by the CLARK ELECTRIC CO., 192 Broadway, N. Y.

Horizontal DRILLING AND BORING MACHINE



Great Power.
WIDE RANGE OF
REVERSIBLE FEEDS.
SEND FOR PRICES & CIRCULARS TO
THE NEWARK MACHINE TOOL WORKS. Newark, N.J.

EUGENE F. PHILLIPS, President. W. H. SAWYER, Sec. & Electrician.

AMERICAN ELECTRICAL WORKS,

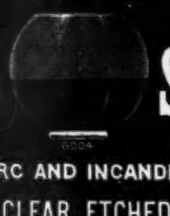
Manufacturers of Patent Finished
ELECTRIC LIGHT WIRE,
MAGNET WIRE, OFFICE & ANNUNCIATOR WIRE.
RUBBER COVERED WIRE, LEAD ENCASED WIRE.
TELEPHONE & INCANDESCENT CORDS.
FARADAY CABLES.
Office and Factory, 67 STEWART STREET., PROVIDENCE, R. I.
New York Office, 10 Cortlandt St., P. C. Ackerman, Agt.

EUGENE F. PHILLIPS, President. JOHN CARROLL, Sec'y-Treas.

EUGENE F. PHILLIPS ELECTRICAL WORKS, LTD

Manufacturers of
ELECTRIC LIGHT WIRE,
MAGNET WIRE, OFFICE & ANNUNCIATOR WIRE,
RUBBER COVERED WIRE, LEAD ENCASED WIRE,
TELEPHONE & INCANDESCENT CORDS.
FARADAY CABLES.
OFFICE AND FACTORY St. Gabriel Locks, MONTREAL, CANADA.

PHŒNIX GLASS CO
OF PITTSBURGH, PA.
MANUFACTURERS OF A FULL LINE OF
ELECTRIC LIGHT



GLOBES SHADES
BOTH ARC AND INCANDESCENT.
RICH CUT, OPAL, CLEAR, ETCHED, ROUGHED, ETC.
ADAPTED TO ALL SYSTEMS.
729 BROADWAY, NEW YORK.
WAVERLY PLACE, AND
43 SIXTH AVE., PITTSBURGH, PA.

HIGHEST AWARD, PARIS EXPOSITION, 1889.

THE ONLY
Gold Medal
AWARDED FOR
Electric Batteries.

TRADE **GONDA** MARK.
The Standard Open Circuit Batteries of the World, AND THE BEST.
THE LECLANCHÉ BATTERY CO.,
149 West 18th Street, New York.

MAKERS OF

ELECTRIC SUPPLIES

GREAT WESTERN ELECTRIC SUPPLY CO.

190-192 FIFTH AVENUE, CHICAGO.

CHUBBUCK BRACKET.

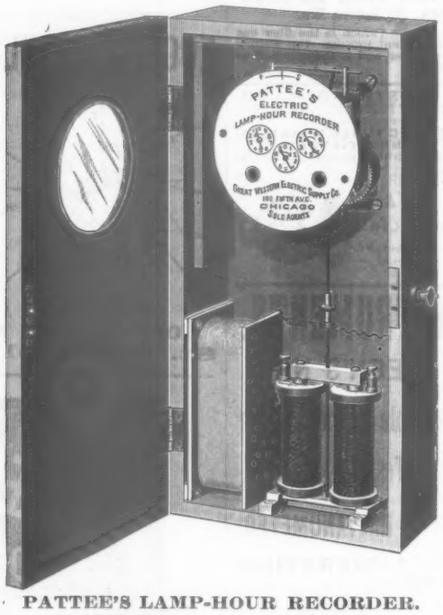
Patent Allowed.

The Strongest, Lightest, Toughest and Most Serviceable

WALL BRACKET.

Made of Malleable Iron.

[Special Circular 513.]



PATTEE'S LAMP-HOUR RECORDER.

[Special Circular Now Out.]

COMBINATION CONE SHADE.

Patent Allowed.

For Westinghouse, Sawyer-Man or T.-H. Sockets.

NEEDS NO HOLDER.

The Most Economical Shade Made.

[Send for Special Circular.]

Send Business Card for a Copy of OUR SKETCH-CATALOGUE.

WILLIAM P. HALL, President. W. S. GILMORE, Treasurer. A. W. HALL, General Manager. S. MARSH YOUNG, General Agent.

THE HALL SIGNAL CO.,

Sole Manufacturers and Owners of

THE NEW HALL SIGNAL.

SEVERAL REASONS WHY IT IS THE BEST:

It is absolutely reliable. It has never given a false signal of safety when danger existed.

It is correct in principle. The breaking of an electric circuit allows the signal to fall to danger.

It is cheaper to erect and maintain than any other signal that has given even approximately satisfactory service.

It is most efficient. It has caused the fewest unnecessary stops in proportion to the number of operations.

It can be operated on either the permissive or absolute block systems, and fully guards against the most prolific classes of railroad accidents.

It does all that is claimed for it, and is so guaranteed.

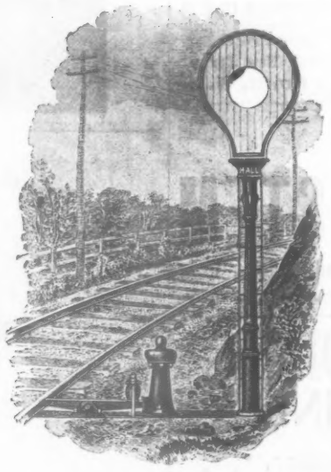
This System is in Operation and Process of Erection on

NEW YORK, NEW HAVEN & HARTFORD R. R.

BOSTON & ALBANY R. R.

NEW YORK CENTRAL & HUDSON RIVER R. R.

And is also being used and introduced on many other Leading Railroads.



We furnish under our System

BLOCK SIGNALS,

INTERLOCKING GRADE CROSSING AND JUNCTION SIGNALS,

SWITCH SIGNALS, STATION SIGNALS,

HIGHWAY GRADE CROSSING SIGNALS,

And such other special applications as may be desired.

WE WILL apply our signals on approval, and give ample time for a thorough trial before payment is required. We are also prepared to supply at our own expense, and **LEASE,** our **AUTOMATIC ELECTRIC SIGNALS** to Railroad Companies at fixed annual rental for a guaranteed service to be rendered, payment of rental to be dependent upon fulfillment of such guarantees.

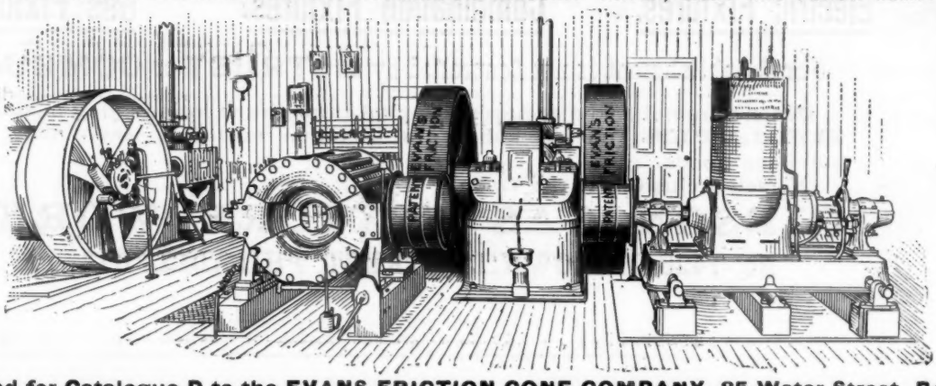
THE HALL SIGNAL COMPANY,

Western Office, Room 340, "The Rookery," Chicago, Ill. 50 BROADWAY, NEW YORK.

THE EVANS SYSTEM OF DRIVING DYNAMOS,

AS USED IN THE STATION OF THE HUTCHINSON (KANSAS) WATER, LIGHT AND POWER COMPANY.

Has been in constant operation since January, 1890.



Fifty full arc Thomson-Houston dynamo and 720-light Edison dynamo.

Send for Catalogue D to the EVANS FRICTION CONE COMPANY, 85 Water Street, Boston.

THE ELEKTRON MANUFACTURING CO.,

79-81 WASHINGTON STREET, BROOKLYN, N. Y.,

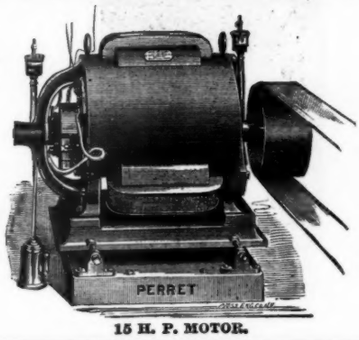
MANUFACTURERS OF

PERRET AUTOMATIC ELECTRIC MOTORS AND DYNAMOS.

EMBODYING LATEST IMPROVEMENTS

And all Desirable Features.

High Standard of Workmanship,
High Efficiency,
Low Speed, Perfect Regulation,
Simplicity.



15 H. P. MOTOR.

MOTORS
FOR RUNNING
Shops, Elevators and Machinery
OF ALL KINDS.

FAN OUTFITS
—FOR—
Battery or Electric Light Circuits.

ISOLATED PLANTS for INCANDESCENT ELECTRIC LIGHTING.

HOLMES, BOOTH & HAYDENS,

MANUFACTURERS OF

BARE AND INSULATED WIRE,

Underwriters' Copper Electric Light Line Wire, handsomely finished, highest conductivity. Copper Magnet Wire, Flexible Silk, Cotton and Worsted Cords for Incandescent Lighting. Round and Flat Copper Bars for Station Work. Insulated Iron Pressure Wire.

TRADE MARK "K.K."

PATENT "K. K." LINE WIRE

TRADE MARK "K.K."

For Electric Light, Electric Railways, Motors, Telegraph and Telephone Use.

Agents for the WASHINGTON CARBON CO.,

FACTORIES: WATERBURY, CONN.

NEW YORK OFFICE, 25 Park Place,

THOS. L. SCOVILL, NEW YORK AGENT

ELECTRICAL SUPPLIES.

AGENTS FOR OKONITE TRADE MARK WIRES, TAPE AND CORD, CANDEE WIRES.

DO YOU WANT THE BEST GOODS? DO YOU WANT GOOD PRICES?
DO YOU WANT PROMPT SHIPMENTS?

If so, Write us for Quotations,

SOUTHERN ELECTRICAL SUPPLY COMPANY,

823 LOCUST STREET, ST. LOUIS, MO.

THE AMERICAN CIRCULAR LOOM CO.,

SOLE MANUFACTURERS OF

PATENT WOVEN INSULATED WIRES

THE HIGHEST ABRASION RESISTANCE AND TENSILE STRENGTH WIRE IN THE MARKET.

Western Agents:
THE ILLINOIS ELECTRIC MATERIAL CO.,
Chicago, Ill.

BOSTON, MASS.,
620 Atlantic Avenue.

Electric Fixtures. Combination Fixtures. Gas Fixtures.

Our Establishment is not Controlled by any **TRUST** or **COMBINE.**

Dealers are not asked to furnish Capital through the intimidating medium of REBATES, nor to submit to Dictation regarding where they shall purchase goods.

We sell exclusively to the Trade.

GIBSON GAS FIXTURE WORKS,

No. 1426 CALLOWHILL STREET, PHILADELPHIA, PA.

THE GETHINS ELECTRICAL MFG. CO.

GETHINS ELECTRICAL MANUFACTURING COMPANY,
620 ATLANTIC AVENUE, BOSTON, MASS.,
HEADQUARTERS FOR THE GETHINS GRAVITY BATTERIES.

This battery is unsurpassed for all kinds of work, such as railway signals, telegraph and fire alarm systems. It has been adopted by the city of Boston for both fire and police signal service. Its E. M. F. is 1.1 volts, internal resistance about 3 ohms. It runs from 12 to 15 months without any attention except a renewal of evaporation, and saves more than 50 per cent. in expense of material.

Price, $1.25 Per Cell.

We call your attention to the following testimonial:

POLICE DEPARTMENT OF THE CITY OF BOSTON,
SIGNAL SERVICE OFFICE,
(A) PEMBERTON SQUARE, April 17, 1890.

To the Honorable the Board of Police Commissioners:

GENTLEMEN:—I herewith report that the Gethins Gravity Batteries placed in Station 10, January 17, 1889, were recharged with new elements of the same kind April 4, 1890, having shown a constant service of 14 months, 18 days. As the service of a battery is in proportion to the work done, I would state that during that time there were received 2,357 wagon signals, 12,237 telephone signals and 198,486 "on duty" signals. As each signal will average ten breaks of the current, this would indicate an armature movement of 2,131,160 times. As compared with the Standard Crowfoot Battery, the best record in this service is 7 months, 23 days.

Respectfully submitted,
(Signed) HENRY A. CHASE, *Electrician.*

☞ **SEND FOR CIRCULAR.**

THE "SPECIAL" GETHINS GRAVITY BATTERY FOR CHARGING STORAGE CELLS.

It has been proved that the Gethins Battery is the most satisfactory one on the market for charging storage cells. Persons having occasion to use small motors to run machines for various purposes, instead of sending their storage cells to a dynamo to be charged, can do it at their house, office or factory with a set of the "Special" Gethins Battery. These batteries have been tested for this purpose for a number of months and have given perfect satisfaction. They can be run very much cheaper than any other.

Price of Battery Ready for Shipment, $1.35 Per Cell.
" " " " " with Chemicals, $1.80 Per Cell.

We call your attention to the following testimonial:

September 11, 1890.

B. F. MESERVEY, Esq.,
Gen'l Manager Gethins Electrical Manufacturing Co.,
620 Atlantic Avenue, Boston, Mass.

DEAR SIR:

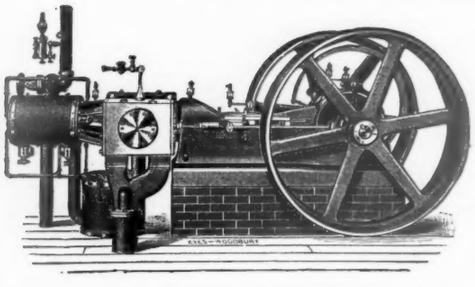
Your favor of yesterday at hand. In regard to the battery which we are using would say that it is doing all the work you claim. We are more than pleased with it, and it is the only "primary" at the present time which we consider satisfactory for such work. I have been using this battery for the past four or five months, and we find that four of the cells connected with a 15 "M" accumulator storage battery will give sufficient power to run our machine with great success. We should advise all persons having occasion to use gravity cells in connection with their storage battery to use yours by all means as it is surely the most economical and gives the best satisfaction of any which we have ever tried.

We are, yours very truly,
NEW ENGLAND PHONOGRAPH CO.,
By AUG. N. SAMPSON, Gen'l Manager.

☞ **THE BEST IS THE CHEAPEST.**

WESTERN POWER CONSTRUCTION CO.,

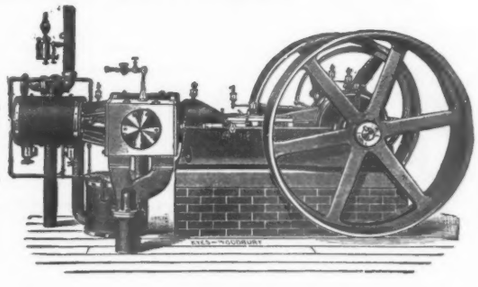
ROOKERY BUILDING, 144 ADAMS STREET, CHICAGO.



McINTOSH & SEYMOUR

TANDEM COMPOUND STEAM
JACKETED CYLINDERS,
SUPERHEATING RECEIVER,
PATENTED VALVE SEAT,
AUTOMATIC RELIEF VALVES.

NOT HOW CHEAP, BUT HOW GOOD.



Complete Steam Plants erected for Electric Light, Railway Duty and Power Purposes.

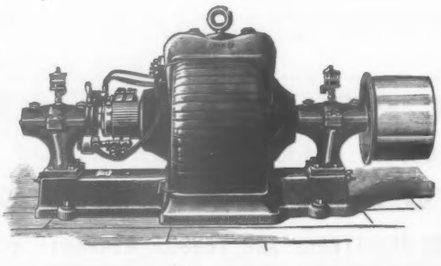
Correspondence Solicited.

"C. & C." ELECTRIC MOTORS.

The only Motors in which the magnetic circuit forms a perfect circle around the centre of the armature shaft. Thus making the most compact and efficient form of machine that can possibly be devised.

One-eighth horse-power to 50 horse-power in stock.

OVER 10,000 MOTORS IN ACTUAL OPERATION.



FAN OUTFITS.

Electric Blowers for Ship Ventilation.

MOTORS FOR HOISTS AND MINING TRAMWAYS.

Equipment of Machine Shops, Printing Offices, Factories and Entire Buildings, with Electric Power.

New England Office, 63 Oliver Street, Boston.
Philadelphia " 38 South Fourth Street.
Chicago " Phenix Building.

"C. & C." ELECTRIC MOTOR COMPANY,

402 & 404 Greenwich Street, New York.

"CANVAS JACKET."

The Boss Moisture and Weather-Proof Wire. Patent Woven Insulation. Forty Per Cent. Longer Life of Insulation. Increase of Eleven Per Cent. Tensile Strength.

ELECTRIC LIGHT AND RAILWAY SUPPLIES.

ILLINOIS ELECTRIC MATERIAL CO., 339-341 Rookery Building, Chicago, Ill.

THE TRANSFORMER SYSTEM.

APPARATUS FOR LONG DISTANCE ELECTRIC LIGHTING.

Complete Central Station Equipments.

WALTER K. FREEMAN, 150 Nassau Street, New York.

☞ *Correspondence Solicited. Specifications and Estimates Furnished Free.*

THE NATIONAL CARBON CO.

CLEVELAND, OHIO.

MANUFACTURERS OF

ELECTRIC LIGHT CARBONS AND BATTERY MATERIAL.

⋈ JULIEN STORAGE BATTERIES ⋈

MANUFACTURED BY

The Consolidated Electric Storage Company.

Exclusive Licensee of the Brush and Julien Storage Battery Patents.

FOR AGENCIES AND LICENSES, ADDRESS THE COMPANY,
120 Broadway, N. Y.

FOR BATTERIES, ADDRESS THE COMPANY,
926 Drexel Building, Philadelphia, Pa.

BROWNLEE & CO.,

DETROIT, MICH.

CEDAR POLES

For Electric Purposes.

THE LARGEST STOCK AND QUICKEST SHIPMENTS.

☞ Manufacturers of the Celebrated Octagonal Red Pine Poles for Electric Railways and Electric Lighting; also Manufacturers of Cross-Arms and Pins.

CLIMAX
RUBBER TAPE
BOSTON RUBBER SHOE CO.
BOSTON MASS
CLIMAX RUBBER TAPE
STRONG AND ADHESIVE
½ lb. ROLLS
¾ in. WIDE
AN INSULATING WATERPROOF COVERING FOR PROTECTING JOINTS AND OTHER EXPOSED PARTS OF TELEGRAPH TELEPHONE OR ELECTRIC LIGHT WIRES
SEND FOR SAMPLE LOT

The Eddy Electric Mfg. Co.

MANUFACTURERS OF

AUTOMATIC ELECTRIC MOTORS,

In all sizes, from 1-2 H. P. upward; High Efficiency; Perfect Regulation; Superior Workmanship; Ease of Management; Remarkable Simplicity, etc., etc.

DYNAMO ELECTRIC MACHINES,

For Electroplating, Electrotyping, Copper Refining, Etc.

NO REVERSING. NO WATER. NO NOISE. NO SPARK.

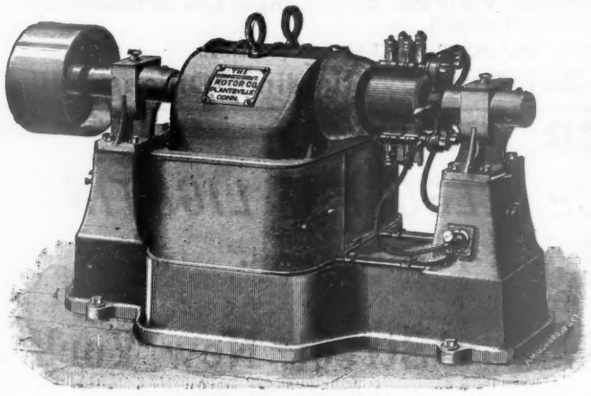
SATISFACTION GUARANTEED.

THE EDDY ELECTRIC MFG. CO., - - WINDSOR, CONN.

NEW YORK: 33 Church St. BOSTON: 111 Arch St. PHILADELPHIA: 506 Commerce St.
CHICAGO: 329 Rookery Building. KANSAS CITY: Rialto Building. NEW ORLEANS: 78 Custom House St.

THE CONNECTICUT MOTOR CO.,

Office and Works, PLANTSVILLE, CONN.
Address, P. O. Drawer 62.



25 HORSE-POWER CONSTANT POTENTIAL MOTOR.

MANUFACTURERS OF

AUTOMATIC ELECTRIC MOTORS.

ALL SIZES, FROM 1-2 TO 50 HORSE-POWER.

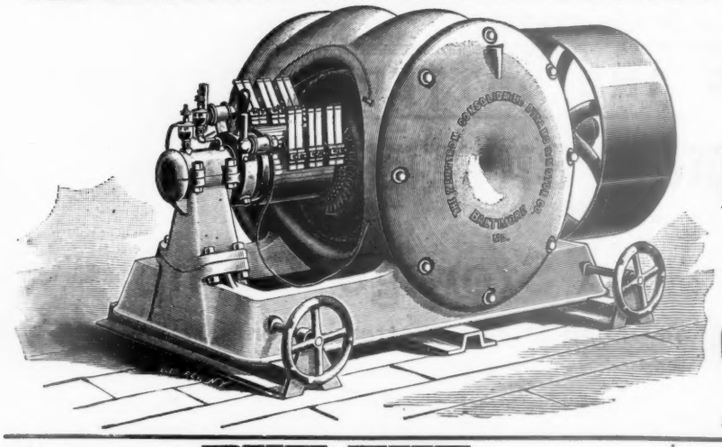
DYNAMOS FOR POWER OR LIGHTING.

Workmanship and Material Unsurpassed.

SIMPLE, DURABLE, EFFICIENT.

NEW YORK: 17 Broadway. BOSTON: 32 Oliver St.
PHILADELPHIA: 17 N. Sixth St. NEW HAVEN: 65 Orange St. HARTFORD: 14 State St.

THE WENSTROM CONSOLIDATED DYNAMO AND MOTOR CO., OF BALTIMORE, MD.,



MANUFACTURERS OF

ELECTRICAL APPARATUS,

ELECTRIC MOTORS FOR ALL WORK,

Dynamos for Incandescent Lighting.

SPECIAL FEATURES:

High Efficiency. ✳ Slow Speed.

For full information and circulars address,

CHADBOURNE, HAZELTON & CO.,

SOLE SELLING AGENTS FOR U. S.,

416-420 WALNUT ST., PHILADELPHIA.

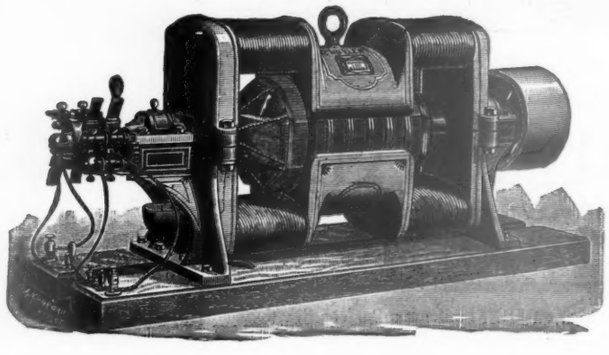
AGENTS WANTED IN ALL LEADING CITIES.

BUY THE

SCHUYLER APPARATUS

IF YOU WANT THE BEST

Arc Lighting System.



Office and Factory, Middletown, Conn.

WESTERN OFFICE,

Room 456, THE ROOKERY.

CHICAGO.

Electric Light Fitting.

A Hand-book for Working Electrical Engineers,

EMBODYING PRACTICAL NOTES ON INSTALLATION MANAGEMENT.

By JOHN W. URQUHART.

Chapter I. Central Station Work.
Chapter II. Localizing Dynamo Faults, and Observations Respecting Accumulators.
Chapter III. Switchboard and Testing Work.
Chapter IV. Arc Light Wiring and Fitting.
Chapter V. Wiring for Incandescent Lamps.
Chapter VI. Incandescent Lighting of Ships.
Chapter VII. Miscellaneous Information.

226 PAGES, NUMEROUS ILLUSTRATIONS.

Price, $2.00.

SENT TO ANY ADDRESS ON RECEIPT OF PRICE.

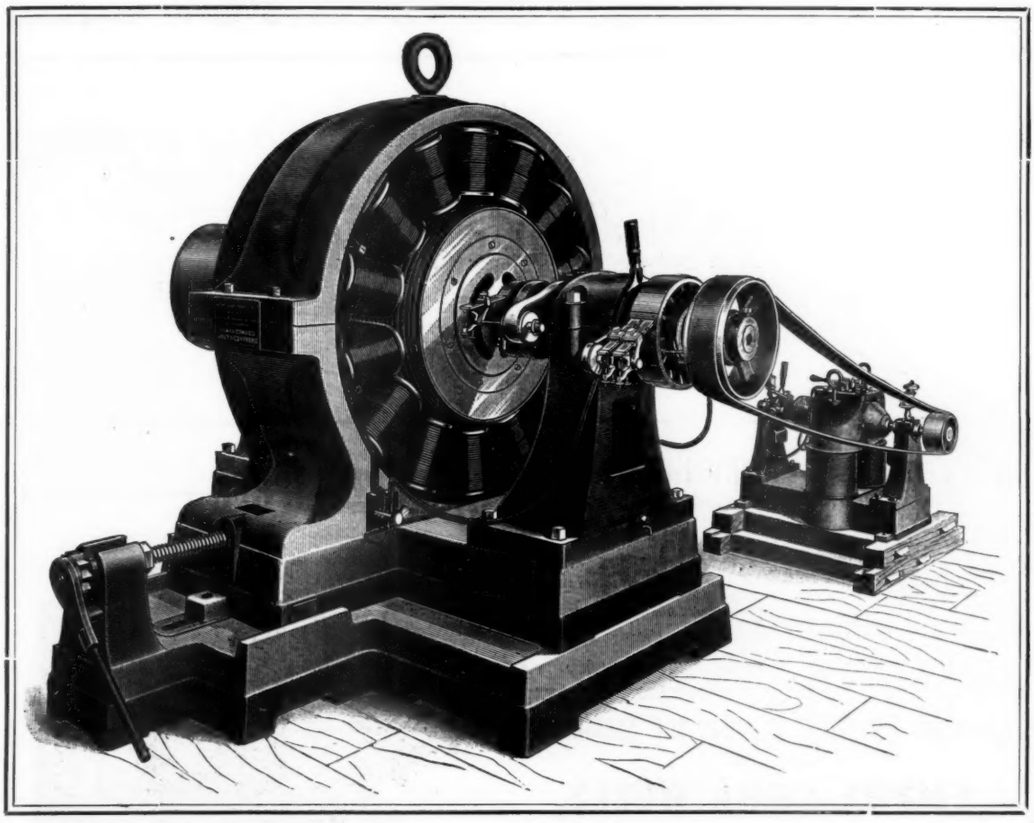
ELECTRICAL REVIEW,
13 Park Row,
P. O. Box 3329. NEW YORK.

IN BUYING THE BEST YOU BUY THE CHEAPEST.

The Thomson-Houston Alternating System

IS THE BEST.

It has proved its merits in actual operation, and they have been fully substantiated by orders for additional equipment from a majority of its users.



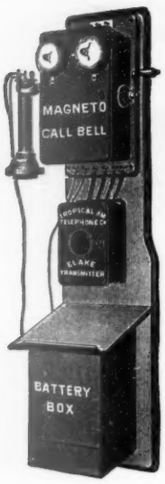
IMPROVED DYNAMOS,

Unequaled in Mechanical Design and Construction,
Self-Regulation and Economy of Operation.

Transformers of the Highest Efficiency.
Superior Incandescent Lamps and Electric Meters.
Complete Central Station Equipments.

THOMSON-HOUSTON ELECTRIC COMPANY,

620 Atlantic Avenue, Boston, Mass.
Wall and Loyd Streets, Atlanta, Ga.
1110 Noble Street, Philadelphia, Pa.
215 West Fourth Street, Cincinnati, O.
503 Delaware Street, Kansas City, Mo.
148 Michigan Avenue, Chicago, Ill.
115 Broadway, New York City.
15 First Street, San Francisco, Cal.
403 & 405 Sibley Street, St. Paul, Minn.
1333 F Street, Washington, D. C.



GENUINE TELEPHONES FOR EXPORT.

THE TROPICAL AMERICAN TELEPHONE COMPANY

Sole Exporters to SOUTH AMERICA, CENTRAL AMERICA and WEST INDIES.

American Bell Telephones, Blake Transmitters and Magnetos, * * *
* * * "Williams" Magneto Call-Bells, and Standard Switchboards.

PATENTED TELEPHONIC APPARATUS AND SUPPLIES OF ALL SORTS AT LOWEST PRICES.

Send for New Illustrated Catalogue and Price List to

New York Office, direct: No. 18 Cortlandt St. – OR – Boston Office: No. 95 Milk St., Box 3318, P. O.

THE E. S. GREELEY & CO., J. H. BUNNELL & CO. AND B. BLUM & CO., ALSO SELL OUR INSTRUMENTS.

LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in inches.	Belt Speed Required.	Weight of Dynamo.
C	8	.....	.....	.....	6.5	1½	5,000 FEET PER MINUTE.	530
C	.....	10	.....	.....	6.3	1½		530
C	.....	.....	.....	25	8.0	2		530
E	16	.....	.....	.....	12.0	2½		780
E	.....	20	.....	.....	12.5	2½		780
E	.....	.....	26	.....	13.0	2½		780
E	20	.....	.....	.....	15.0	3		990
E	.....	25	.....	.....	15.6	3		990
E	.....	.....	32	.....	15.0	3		990
E	.....	.....	.....	50	16.0	3		990
G	28	.....	.....	.....	21.0	4½		1,360

Ball Electric Light Co.
404
WEST 27th STREET.
NEW YORK

LIST OF DYNAMOS IN STOCK.

Designation of Machine.	No. Lights 2,000 c. p. 10 amp. X	No. Lights 1,600 c. p. 8 amp. Y	No. Lights 1,200 c. p. 6 amp. Z	No. Lights 800 c. p. 4 amp.	Horse-Power at Pulley of Dynamo.	Width of Single Belt in inches.	Belt Speed Required.	Weight of Dynamo.
G	.....	35	.....	.....	21.0	4	5,000 FEET PER MINUTE.	1,360
G	.....	.....	45	.....	21.0	4		1,360
G	.....	.....	.....	70	21.0	4½		1,360
H	40	.....	.....	.....	29.7	6		1,750
H	.....	50	.....	.....	30.0	6		1,750
H	.....	.....	64	.....	29.5	6		1,750
I	52	.....	.....	.....	38.0	8		2,290
I	.....	65	.....	.....	38.6	8		2,250
I	.....	.....	83	.....	38.0	8		2,290
J	64	.....	.....	.....	46.5	10		2,770
J	.....	80	.....	.....	47.1	10		2,770
K	75	.....	.....	.....	52.5	12		3,200

The Burton Electric Heater for Electric Railway Cars

NO SMOKE! NO GASES! EASILY MANAGED! ECONOMY IN SPACE!

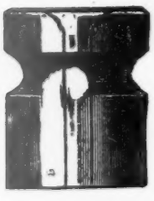
Normal use of current, THREE AMPERES, and the cost of this is in the coal burned at the generating station, which is actually LESS than that of coal burned in a stove on a car.

"They are giving us and the public entire satisfaction."—RICHMOND, VA., U. P. RY. CO.
"The heat is pleasant, sufficient and economical."—MARLBOROUGH, MASS., STREET RY. CO.
"We are much pleased with them, and know of no reason why we shall not continue to use them and recommend them to others."—ST. LOUIS AND EAST ST. LOUIS ELECTRIC RY. CO.

AGENCIES: { Equitable Electric Ry. Construction Co., 416-420 Commercial Union Building, Phila., Pa.
Higgins Brothers & Co., 202 Main Street, Buffalo, N. Y.
Electric Merchandise Co., 11 Adams Street, Chicago, Ill.

For Further Information, Address

THE BURTON ELECTRIC COMPANY, RICHMOND, VA.



Porcelain Electrical Supplies and Specialties,

MANUFACTURED BY

EMPIRE CHINA WORKS,

144 & 156 Greene St., GREENPOINT, BROOKLYN, E. D., N. Y.

Our Ware is HARD PORCELAIN, the BODY and GLAZE IDENTICAL, and GUARANTEED NON-CONDUCTIVE for all ELECTRICAL PURPOSES.

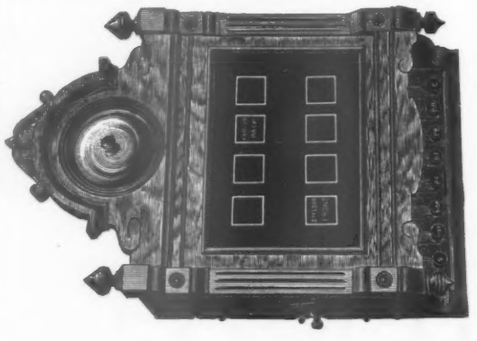
THE American Bell Telephone Company,

95 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent granted to Alexander Graham Bell, March 7th, 1876, No. 174,465, and January 30, 1877, No. 186,787.

The Transmission of Speech by all known forms of ELECTRIC SPEAKING TELEPHONES infringes the right secured to this Company by the above patents, and renders each individual user of telephones, not furnished by it or its licensees, responsible for such unlawful use, and all the consequences thereof and liable to suit therefor.

Manufacturers



H. E. & C. BAXTER,
18 FULTON STREET,
Brooklyn, N. Y.

THE HOLTZER-CABOT ELECTRIC CO.,

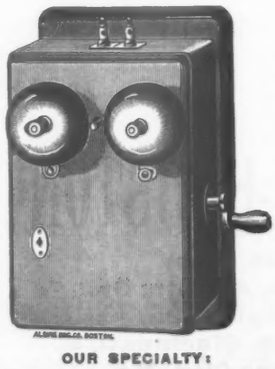
Manufacturers and Dealers in all Kinds of

ELECTRICAL APPARATUS.

Office and Warerooms: 111 ARCH STREET, BOSTON.

Factory: BROOKLINE, MASS.

Special Agencies: Clower & Harris, Dallas, Tex.; Paul Seiler's Electric Works, San Francisco, Cal. Where a full line of our goods is carried in stock.



OUR SPECIALTY:
Standard and Pony Magneto Bells.

Enclose Business Card and Send for Illustrated Catalogue.

Standard and Pony Extension Bells.

FARADAY CARBON CO.,
ELECTRIC LIGHT CARBONS, PITTSBURGH, PA.

SUBSCRIBE NOW FOR THE ELECTRICAL REVIEW.

DRILLS

Something New! One, two, three, and four spindle drills for light work.

The most useful patented improvement in drill presses for years is applied.

SENSITIVE

Spindles driven with single, endless belts. Large driving pulleys, tightener and variable speeds provided.

Over 1,000 in use. Buy the **latest** and **best.** Special machinery to order. Catalogue of fine tools free.

Dwight Slate Machine Co.

HARTFORD, CONN.

ROYCE & MAREAN,
DEALERS IN
ELECTRICAL APPARATUS,
Telegraph and Telephone Supplies,
No. 1408 Penna. Avenue,
Opp. Willard's Hotel. WASHINGTON, D. C.

THE
PARKER-RUSSELL MINING & MFG. CO.
MERMOD-JACCARD BUILDING,
Cor. Broadway and Locust St. Rooms 307 and 308.
ST. LOUIS.

SUNLIGHT CARBONS

UNIFORM IN QUALITY, LONG LIFE AND GOOD LIGHT

Washburn & Moen Mfg. Co.
WORCESTER, MASS.
MAKERS OF
IRON AND STEEL
MANUFACTURERS OF
Iron and Copper Wire for Electrical Purposes.
PATENT GALVANIZED TELEGRAPH & TELEPHONE WIRE,
In Long Lengths, Galvanized by our Patent Continuous Process.

The Standard with all Telegraph and Telephone Companies.

Since the first introduction of the Electric Telegraph Service, our patent wire, expressly manufactured for electric purposes, has filled every requisition as regards strength, evenness of quality, and conductive capacity.

Send for Price Lists and descriptive pamphlets, and "Hand-book of Wire in Electric Service." Sent free on application.

New York Warehouse, 16 CLIFF STREET.
Chicago Warehouse, 107 & 109 LAKE ST.

GIVES MORE POWER USING LESS WATER THAN ANY OTHER WHEEL.

THE OLD RELIABLE —LEFFEL— WATER WHEEL
SEND FOR CATALOGUE.
JAMES LEFFEL & CO.
SPRINGFIELD, O., OR 110 LIBERTY ST., N.Y.

"Prices are low yet quality tells."
A Corliss Engine
well designed and thoroughly built, is the best the world today possesses.
The Lane & Bodley Co., Cincinnati, O., have a high ideal of what their engines should be, and invite their customers to say what they are. If you want an engine and never have seen one of these, write for descriptive circular.
THE LANE & BODLEY CO.,
CINCINNATI, O.

Electric Bells and all About Them.

BY S. R. BOTTONE.

A Practical Book for Practical Men.

WITH MORE THAN 100 ILLUSTRATIONS.

SECOND EDITION. REVISED.

PRICE, - - 50 CTS.

SENT POSTAGE PREPAID TO ANY ADDRESS ON RECEIPT OF PRICE.

Electrical Review,
13 PARK ROW,
P. O. Box 3329. NEW YORK.

NEW YORK BELTING AND PACKING CO.
LARGEST BELTS IN THE WORLD.
RUBBER BELTING, PACKING, HOSE,— —MATS, MATTING, STAIR-TREADS.
15 PARK ROW, NEW YORK.
(OPPOSITE ASTOR HOUSE.)
J. H. CHEEVER TREAS. J. D. CHEEVER DEP'Y. TREAS.

DOUBLE ARC LAMPS.

No finely geared clock-work. No close fitting sliding solenoid cores. No steel pinions or pivots to rust and stick. No gearing to clog with dust. Practically and theoretically the simplest and best constructed Double Arc Lamp. The only Double Arc Lamp manufactured for both high and low tension currents.

We offer to furnish companies using high or low tension systems with new Double Arc Lamps, guaranteed to work satisfactorily, and with guarantee against loss on account of suits for alleged infringement of patents.

WESTERN ELECTRIC COMPANY,
CHICAGO. NEW YORK. LONDON. ANTWERP. BERLIN. PARIS.

FORT WAYNE ELECTRIC COMPANY,

FORT WAYNE, IND.

MANUFACTURERS OF THE

Slattery Induction System of Long Distance Incandescent Lighting

AND THE

***** Wood Automatically Regulating *****

ARC DYNAMO AND LAMPS.

Main Office, FORT WAYNE, IND.

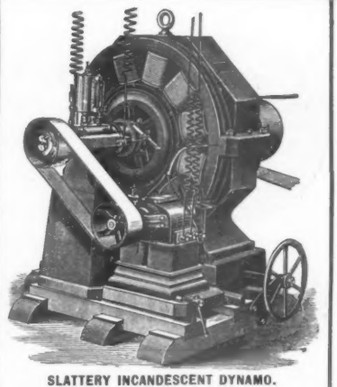
WOOD DYNAMO.

BRANCH OFFICES:

NEW YORK, -	115 Broadway.
PHILADELPHIA,	907 Filbert Street.
PITTSBURGH, PA.,	533 Wood Street.
CHICAGO, - -	185 Dearborn Street.
SAN FRANCISCO,	35 New Montgomery Street.
DETROIT, MICH.,	57 Gratiot Avenue.
TORONTO, CANADA,	138 King Street.
MEXICO, F. Adams' Successors, City of Mexico.	

FACTORIES:

FORT WAYNE, - - - -	INDIANA.
BROOKLYN, - - - -	NEW YORK.



SLATTERY INCANDESCENT DYNAMO.

THE

EMPIRE CITY ELECTRIC Co.

HELMET BRAND. WATER PROOF. WEATHER PROOF.

INSULATED WIRE.

Telegraph, Telephone and Electric Light

WIRES AND CABLES.

HARDTMUTH EMPIRE CARBONS.

HARD AND SOFT CORED.

Mason Primary Batteries.

HOUSE WORK MATERIAL.

Batteries, Wire, Bells, Push-buttons, Flexible Cord, Burglar Alarms, Etc., Etc.

ELECTRIC LIGHT MATERIAL.

Poles, Cross-arms, Pins, Insulators, Brackets, Switches, Cut-outs, Lamps, Fixtures, Shades, Shade-holders, Etc., Etc.

ALL KINDS OF

ELECTRICAL SUPPLIES

Send for Wire Price-List and Catalogue to

The Empire City Electric Co., 15 Dey Street, N. Y.

THE IMPROVED

Corrugated Tube Feed Water Heater.

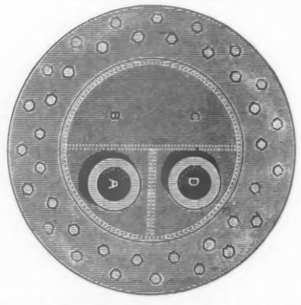
THE

WAINWRIGHT MFG. CO.

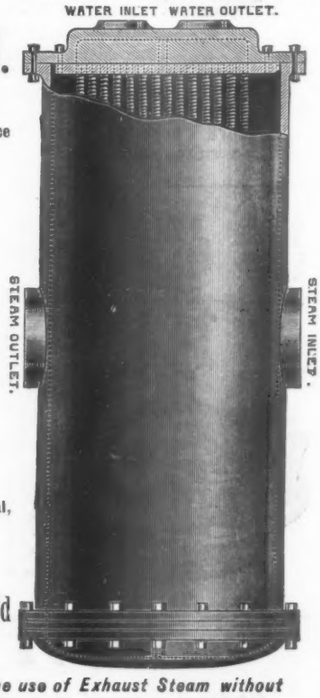
OF MASSACHUSETTS,

SOLE MANUFACTURERS OF THE

Corrugated Tube Feed Water Heaters, Surface Condensers, Expansion Joints, Expansion Tubes for Compound Engines,



END VIEW.



Coil and Straight Tube, Vertical or Horizontal, Feed Water Heaters, Harvard Pump Regulators, Automatic Gauge Valves, Barnard's Separator.

All Heaters and Condensers Sold Under Ten Years' Guarantee.

The Highest Known Results from the use of Exhaust Steam without Back Pressure.

SEND FOR CATALOGUE "A" TO

8 OLIVER STREET (Vulcan Building), BOSTON, MASS.

F.B. ASPINWALL, 112 Liberty St., N.Y. H. S. WALKER, 26-28 W. Randolph St., Chicago.
ST. LOUIS MECH. SUPPLY COMPANY, St. Louis and Kansas City, Mo.
RUSSELL & CO., ST. PAUL, MINN.

CONVERTER EFFICIENCIES.

It will PAY YOU to throw out your Present Converters and Substitute OUR MAKE.

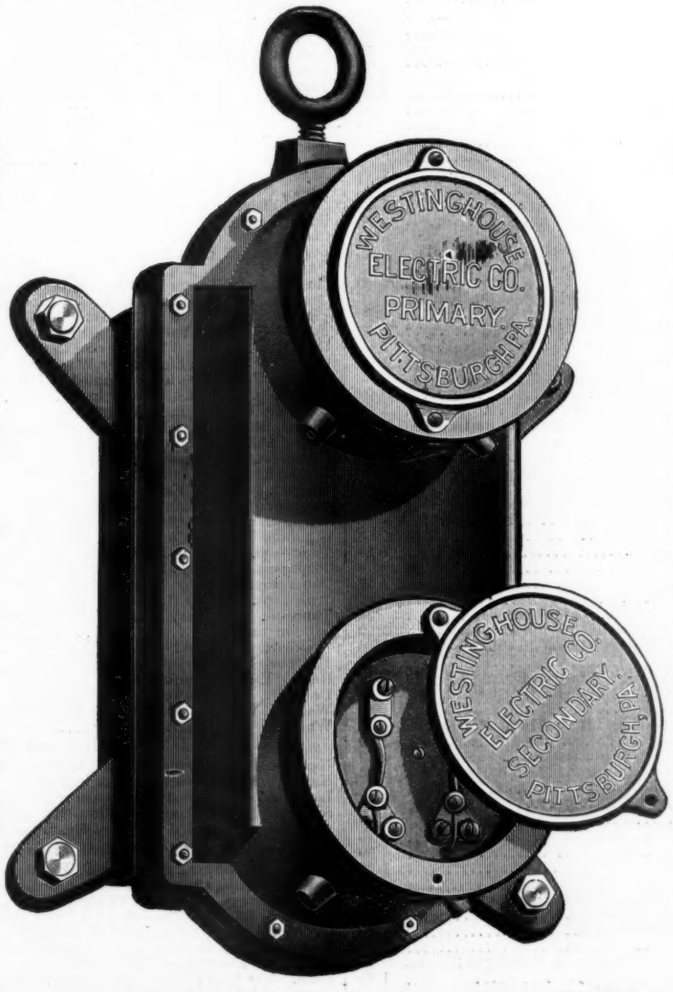
COMPARISON OF CONVERTERS.

	TOTAL EFFICIENCY.	CONVERTER CAPACITY TESTED.
Thomson-Houston	87.50 per cent.	25
Ft. Wayne Jenney	87. "	25
National,	88. "	20
WESTINGHOUSE	95. "	20

The above figures speak for themselves. You can afford to throw away your inefficient Converters and buy Ours, which will pay for themselves within a reasonable time, and permit you to carry a larger commercial load on a given dynamo.

Incandescent Alternating Current Dynamos, CONVERTERS, Meters, Motors.

325 Central Stations and 600,000 Lamps!



Alternating Current Arc Lighting Apparatus.

Lamps burn 40 Hrs. without renewal of Carbons!

Arc Lighting Revolutionized

Send for Special Circular.

55 Plants and 5000 Lamps sold within a few months.

Correspondence Solicited.

WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.,

PITTSBURGH, PA., U. S A.,

BOSTON, NEW YORK, CHICAGO, CINCINNATI, ST. LOUIS, SAN FRANCISCO, PORTLAND.

AMERICAN AND FOREIGN BOOKS
ON ELECTRICITY AND ITS APPLICATIONS.

Electricity, Magnetism, Etc., Etc.

Adams. Essay on Electricity $4 00
Angell. Elements of Magnetism and Electricity. Cloth, 288 pages, 151 illustrations 75
Anderson. Lightning Conductors. Cloth 6 50
Atkinson. Elements of Static Electricity 1 50
Ayrton. Practical Electricity. For students of electrical engineering. 516 pages, 180 illustrations 2 50
Barlow. Magnetic Attractions 4 00
Barnard. First Steps in Electricity 75
Benjamin. Age of Electricity 2 00
Brennan. A Popular Exposition of Electricity. 191 pages 75
Blakesley. Alternating Currents of Electricity. Cloth 1 50
Bottone. The Dynamo. How Made and How Used. A book for amateurs. Cloth. 1 00
Cavendish. Electrical Researches. Cloth 5 00
Cook. Magnetism and Electricity. Cloth, 48 illustrations 40
Cumming. Electricity Treated Experimentally. Cloth, 100 diagrams 1 50
Davis. Manual of Magnetism, Galvanism, etc. 3 00
Deschanel. Electricity and Magnetism. Cloth 1 50
De Fonvielle. Thunder and Lightning. Cloth, 285 pages 1 00
De La Rue. Experimental Researches in the Electric Discharge with the Chloride of Silver Battery 3 60
Du Moncel. Electro-Magnets. Boards, 50c.; English Edition 75
Dunman. Short Text Book of Electricity and Magnetism 40
Dyer. Induction Coils; How Made and How Used. Boards 50
Electricity in the Service of Man 6 00
Everett. Units and Physical Constants 1 10
Faraday. Experimental Researches in Electricity. 3 vols., cloth 20 00
Fiske. Electricity in Theory and Practice. Cloth, 270 pages, 180 illustrations 2 50
Ferguson. Electricity. Cloth 1 50
Fleming's. Short Lectures to Electrical Artisans 1 50
Francis. Electrical Experiments 2 50
Gordon. School Electricity. Cloth, 262 pages, 139 illustrations 2 00
Gordon. A Physical Treatise on Electricity and Magnetism. 2 vols., cloth 10 00
Gladstone & Tribe. The Chemistry of the Secondary Batteries of Plante and Faure. 1 00
Gordon. Four Lectures on Static Electric Induction. Cloth 80
Guthrie. Magnetism and Electricity 1 25
Hamilton. The Origin of Energy, Electrostatics and Magnetism 2 00
Heap. Electrical Appliances of the Present Day. Cloth 2 00
Hospitalier. Domestic Electricity. Cloth, 229 pages, 155 illustrations 3 00
Hospitalier. The Modern Applications of Electricity. Cloth 8 00
Harris. Rudimentary Electricity. Flexible, 69 illustrations 60
Harris. Rudimentary Magnetism. Cloth, 165 illustrations 1 40
Harris. Galvanism, Animal and Voltaic Electricity 60
Hering. Winding Magnets for Dynamos. 63 pages 1 25
Jeans. Lives of the Electricians 2 25
Jenkin. Electricity and Magnetism. Cloth, 177 illustrations 1 50
Kirwan. Modern Electricity with Glossary of Electrical Terms. 128 pages 30
Kohlrausch. Physical Measurements, with Appendices on Absolute Electrical Measurements 6 00
Lardner. Hand-Book of Electricity, Magnetism and Acoustics. 400 illustrations, cloth 2 00
Levander. Solutions of Questions in Magnetism and Electricity. Cloth 1 00
Lightning Flashes and Electric Dashes 1 00
Lloyd. Treatise on Magnetism 5 00
Lock. Workshop Receipts. Devoted mainly to Electrical and Metallurgical subjects. Cloth 2 00
Mahon. Principles of Electricity 5 00
Martin & Wetzler. Electric Motor and its Applications. 208 pages, 199 illustrations. 3 00
Mascart & Joubert. A Treatise on Electricity and Magnetism. Vol. 1, cloth, 654 pages, 127 illustrations 7 50
Maxwell. A Treatise on Electricity and Magnetism. 2 vols., 20 plates and 105 illustrations 8 00
Maxwell. An Elementary Treatise on Electricity. 6 plates, 54 illustrations 2 00
May. Bibliography of Electricity 2 00
McClure. Edison and his Inventions 1 00
Mendenhall. A Century of Electricity 1 25
Merwin. Patentability of Inventions 6 00
Miller. Magnetism and Electricity. 212 pages, illustrated 2 50
Munro. Electricity and its Uses. Cloth 1 40
Murdock. Notes on Electricity and Magnetism. Cloth, 38 illustrations 60
Munro & Jamieson. Electrician's Pocket-Book of Electrical Rules and Tables 2 50
Niaudet. Elementary Treatise on Electric Batteries. Cloth, 55 illustrations 2 50
Nipher. Theory of Magnetic Measurements 1 00
Noad. The Student's Text-Book of Electricity. Cloth, illustrated 4 00
Overend. Elementary Experiments in Magnetism and Electricity. Cloth 40
Parkinson. Ocean Telegraph to India 4 00
Parnell. Action of Lightning and Means of Defending Life and Property from its Effects 3 00
Plante. Storage of Electrical Energy. 268 pages, 89 illustrations 4 00
Pynchon. Introduction to Chemical Physics. 550 pages, 269 illustrations 3 00
Radau. Wonders of Acoustics; or, The Phenomena of Sound. Cloth, 288 pages, 116 illustrations 1 00
Rankine. Rules and Tables for Engineers 4 00
Reports of the Committee on Electrical Standards. Cloth 3 75
Rogers. Magnetism of Iron Vessels 50
Salomons. The Management of Accumulators 1 20
Spang. Treatise on Lightning Protection. Cloth, illustrated 75
Stewart & Gee. Electricity and Magnetism. 497 pages, 223 illustrations 2 25
Swinburne. Practical Electrical Units Popularly Explained. Cloth 60
Tarn. Magnetism and Electricity. A book for students 80
Techno-Chemical Receipt Book 2 00
Thompson. Elementary Lessons in Electricity and Magnetism. Cloth, 168 illustrations 1 25
Thompson. Recent Progress in Dynamo Electric Machinery 50
Thomson. Electro-Statics and Magnetism 5 00
Treglohan. Frictional Electricity 50
Tyndall. Lessons in Electricity at the Royal Institute, 1875-6. Cloth 1 00
Watson and Burbury. The Mathematical Theory of Electricity and Magnetism. Cloth, 268 pages 2 75
Wonders of Acoustics; or, The Phenomena of Sound. Cloth, 288 pages 1 00
Woodbury's Protection and Construction of Mill Floors. Cloth 2 50
Welch. Table of Relative Weights of Copper Conductors 10
Woodward. Arithmetical Physics. Boards 80

Telegraphy and Telephony.

Abernethy. Commercial and Railway Telegraphy. Illustrated, cloth 3 00
Beechey. Electro-Telegraphy. Cloth, 36 illustrations 40
Clarke & Sabine. Electrical Tables and Formulæ. Cloth 5 00
Culley. Hand-Book of Practical Telegraphy. Cloth, 442 pages 6 00
Davis & Rae. Hand-Book of Electrical Diagrams and Connections 2 00
Douglas. A Manual of Telegraph Construction. 83 diagrams, cloth 6 00
Fahie. History of Telegraphy to 1837. Cloth, 529 pages 3 00
Field. History of Atlantic Telegraph 1 25
Globe Telegraph Code 2 00
Hoskiaer. Laying and Repairing Electric Telegraph Cables. Cloth 1 50
Hoskiaer. A Guide for the Electric Testing of Telegraph Cables. Cloth 1 50
Jones. Historical Sketch of the Electric Telegraph 2 00
Lardners. Electric Telegraph Popularized 1 50
Lockwood. Electricity, Magnetism and Electric Telegraphy. Cloth, 376 pages 2 50
Loring. A Hand-Book of the Electro-Magnetic Telegraph. Boards, 50c.; cloth, 75c.; morocco 1 00
Maver & Davis. The Quadruplex. Cloth, 126 pages 1 50
Mullaly. Laying of the Cable 4 00
Pope. The Modern Practice of the Electric Telegraph. Cloth, 70 illustrations 1 50
Plum. The Military Telegraph During Our Civil War. Two vols., portraits and illustrations 5 00
Preece & Silveright. Telegraphy. Cloth 1 50
Prescott. Electricity and the Electric Telegraph. Cloth, 670 illustrations, 2 vols. 5 00
Sabine. History and Progress of the Electric Telegraph. Cloth, 134 illustrations. 1 25
Sauer. Telegraph in Europe 4 00
Schwendler. Instructions for Testing Telegraph Lines. 2 vols., cloth, illustrated. 8 00
Smith. Manual of Telegraphy. 31 illustrations, paper 30
Telegraphic Tests 5 60
Terry & Finn. Illustrations and Descriptions of Telegraphic Apparatus. Cloth, 92 pages, 30 plates 1 50
Williams. Manual of Telegraphy. Cloth, 327 pages, 90 illustrations 4 00
Dolbear. The Telephone. Cloth, illustrated 50
Du Moncel. The Telephone, the Microphone and the Phonograph. 70 illustrations, cloth 1 25
Lockwood. Practical Information for Telephonists. Cloth 1 00
Prescott. Bell's Electric Speaking Telephone. 526 pages, 330 illustrations 4 00
Thompson. Philip Reis, Inventor of the Telephone. Cloth, 3 plates and 48 engravings 3 00

Electric Lighting and Transmission of Power.

Alglave & Boulard. The Electric Light. Its History, Production and Application. 458 pages 5 00
Atkinson. Elementary Principles of Electric Lighting 1 50
Badt. Dynamo Tenders' Hand-Book. General Rules for the Care and Operation of Electric Light Plants. 70 illustrations, 93 pages 1 00
Badt. Incandescent Wiring Hand-Book 1 00
Cunynghame. A Treatise on the Law of Electric Lighting. Cloth 5 00
Day. Electric Light Arithmetic. Cloth 40
De Cew, Glacer. Magneto and Dynamo Electric Machines 3 00
Du Moncel. Electric Lighting. 66 illustrations, cloth 1 25
Dredge. Electric Illumination. 2 vols., cloth. Vol. 1 (scarce), $15. Vol. 2 ..... 7 50
Electric Lighting Act, 1882, also the Rules of Board of Trade, October, 1882 ..... 2 00
Foote. Economic Value of Electric Light and Power. 191 pages 1 00
Gordon. A Practical Treatise on Electric Lighting. Cloth 4 50
Grierson. Electric Lighting by Water Power 40
Hedge. Precautions to be Adopted on Introducing the Electric Light 1 00
Hedges. Central Station Lighting. Paper 20
Holmes. Practical Electric Lighting. Cloth 1 00
Higgs. Magneto and Dynamo Electric Machines. 301 pages 2 00
Kapp. Alternate Current Machinery 50
Maier. Arc and Glow Lamps 3 00
Pope. Evolution of the Electric Incandescent Lamp 1 00
Prescott. Dynamo-Electricity. Cloth 5 00
Stephen. Wrinkles in Electric Lighting. Cloth, 45 pages, 23 illustrations 1 00
Schellen. Magneto-Electric and Dynamo Electric Machines. Cloth 5 00
Schilling. Present Condition of Electric Lighting 50
Thompson. Dynamo-Electric Machines. Illustrated, boards 50
Thompson. Dynamo-Electric Machinery. 57 illustrations, boards 50
Thompson. Dynamo-Electric Machinery. Cloth, 527 pages, 324 illustrations 5 00
Thompson. Recent Progress in Dynamo-Electric Machinery 50
Thurston. Stationary Steam Engines, especially as adapted to Electric Lighting Purposes 2 00
Urquhart. Electric Light: its Production and Use. Cloth, 94 illustrations 3 00
Du Moncel. Electricity as a Motive Power. Cloth 3 00
Kapp. Electric Transmission of Energy and its Transformation 3 00
Urquhart. Electro-Motors. Illustrated 3 00
Walker. Practical Dynamo Building for Amateurs 80
Whipple. The Electric Railway 1 00

Testing and Measurements.

Haskins. The Galvanometer and its Uses. Morocco, 8 illustrations 1 50
Kempe. A Hand-Book of Electric Testing. Cloth, 494 pages 5 00
Lockwood. Electrical Measurements and the Galvanometer. Cloth 1 50
Smith's. Dynamometric Measurements 40
Swinburne. Practical Electrical Measurement. 55 illustrations, 155 pages 1 75

Electro-Metallurgy, Electrotyping, Etc., Etc.

Badt. Bell Manger's Hand-Book. Practical Information and Suggestions to persons having Charge of Batteries, Bells, Annunciators and Electric Gas Lighting Apparatus. 105 pages, 97 illustrations 1 00
Bottone. Electric Bells and All About Them. Practical Instruction for Electric Bell Fitters. Over 100 illustrations, 190 pages 1 20
Bottone. Electrical Instrument Making for Amateurs 2 00
Fontaine. Electrolysis. Cloth, 264 pages 3 50
Gore. The Art of Electro-Metallurgy. Cloth, illustrated 2 25
Napier A Manual of Electro-Metallurgy. Cloth 3 00
Urquhart. Electrotyping. A Practical Manual 2 00
Urquhart. Electroplating. Cloth 2 00
Wahl. Galvanoplastic Manipulations. Cloth 7 50
Watt. Electro-Metallurgy Practically Treated. Cloth 1 00
Watt. Electro-Deposition. Cloth, 568 pages, 144 illustrations 3 50
Wilson. Stereotyping and Electrotyping. Cloth, 195 pages 2 00

☞ Copies of any of the above books will be promptly mailed, POSTAGE PREPAID, to any address in the world on receipt of price. Remit by Express or Post Office Money Order, Postal Note, Draft or Registered Letter. Address

ELECTRICAL REVIEW PUB. CO.,

P. O. BOX, 3329. **13 PARK ROW, NEW YORK.**

SOUTH LAKEWOOD PARK.

THE

ELECTRIC CITY

ADJOINING

Lakewood, N. J., The Great Winter Resort.

Persons desiring to secure lots in this favored location, address,

THE ELECTRIC CITY COMPANY,

5 & 7 Dey Street, N. Y.

Names of the Avenues which are now being laid out in South Lakewood Park:

EDISON AVENUE.
BRUSH AVENUE.
THOMSON AVENUE.
OHM AVENUE.
WESTINGHOUSE AVENUE.
FARADAY AVENUE.
FRANKLIN AVENUE.
UNITED STATES AVENUE.
HENRY AVENUE.
WATT AVENUE.
PLANTE AVENUE.
GRAMME AVENUE.

IT IS THE PURPOSE OF THIS COMPANY TO NAME THE AVENUES OF THE CITY, NOW BEING LAID OUT, AFTER PROMINENT ELECTRICIANS AND ALSO TO INTRODUCE THEREIN THOSE ELECTRICAL INVENTIONS MOST LIKELY TO CONDUCE TO THE HEALTH, COMFORT AND PLEASURE OF ITS PATRONS.

A
B
C
And Everything Up To
Z

OCTOBER 1st, 1890.

IN

ELECTRICAL SUPPLIES

WILL BE FOUND AT

Alexander, Barney & Chapin,

20 CORTLANDT STREET,

TELEPHONE: 1139 CORTLANDT.

NEW YORK.

TO INVENTORS:

The Electrical Review Patent Bureau

Conducts a General Soliciting Business, and is prepared to do thoroughly first-class work in procuring patents in the United States and all foreign countries.

THE MANAGER OF THE BUREAU

has had the advantage of a wide experience with electrical inventions, formerly in the Examining Corps of the Patent Office, where he was detailed to examine electrical inventions, and for the past three years as an active practitioner.

Correspondence is strictly confidential, and any readers of this journal who may desire any information relating to patents need have no hesitation in addressing the Patent Bureau.

Our aim is to give prompt and efficient assistance to inventors at moderate rates. We are gratified to be able to say that the Bureau enjoys the highest esteem of all inventors who have hitherto invited it to take charge of their patent interests.

REPORTS UPON PATENTABILITY OF INVENTIONS; INVESTIGATIONS OF QUESTIONS OF INFRINGEMENT or VALIDITY OF PATENTS ALREADY ISSUED; PROSECUTION OF APPLICATIONS; EXPERT ADVICE IN RESPECT OF INVENTIONS, and all business relating to or depending upon patents is carefully attended to.

ELECTRICAL INVENTIONS } Are a Special Feature.

In this rapidly growing art, where inventors are constantly treading upon one another's heels, it is dangerous to defer steps to protect a patentable idea.

All communications should be addressed to the

MANAGER OF PATENT BUREAU,

Electrical Review,

13 Park Row, New York.

EDISON GENERAL ELECTRIC COMPANY.—RAILWAY DEPARTMENT.

More than 100 Different Street Railways in Operation or in course of Construction.
More than 175 Separate Orders from Street Railways for Electrical Equipments.

OUR ELECTRIC RAILWAY SYSTEM HAS BEEN APPROVED TO BE THE MOST DURABLE, RELIABLE, ECONOMICAL AND CONVENIENT.

Please Address all Communications to the Nearest District Office.

MAIN DISTRICT OFFICES:

NEW YORK, EDISON BUILDING. DENVER, COLO., MASONIC BUILDING. SAN FRANCISCO, 112 BUSH STREET.
NEW ORLEANS, COTTON EXCHANGE. CHICAGO, RIALTO BUILDING. PORTLAND, ORE., WASHINGTON BUILDING.
TORONTO, CANADA, BANK OF COMMERCE BUILDING.

ELECTRIC MERCHANDISE COMPANY,

Opposite Pullman Building, 11 ADAMS STREET, CHICAGO, ILL.

THE ONLY COMPANY IN THE UNITED STATES MAKING AN EXCLUSIVE BUSINESS OF MANUFACTURING

ELECTRIC RAILWAY SUPPLIES

FOR ALL SYSTEMS.

W. R. MASON, Gen'l Manager.

Standard and Special Designs for Car, Station and Line Work.
CATALOGUES FURNISHED. CORRESPONDENCE SOLICITED.

SEALINE INSULATING WATER AND FIRE-PROOF LIQUID PAINT

Used for the following Electrical Purposes:

INSULATING,
CONNECTIONS,
EXTERIOR CABLES,
CONVERTER BOXES,
CUT OUT BLOCKS,

DYNAMO BASES,
LAMP HOODS,
PAINTING EXTERIOR OF WIRES,
AND ALL KINDS OF IRON AND TIN WORK.

HAS NO DISAGREEABLE ODOR.

MANUFACTURED BY

JOHN A. SEELY, President. SEELY & TAYLOR MANUFACTURING COMPANY, JAMES A. TAYLOR, Sec. and Treas.

24 Cortlandt Street and 19 Dey Street, New York City.

SAWYER-MAN

ANY CANDLE POWER. LAMPS TO FIT ANY SOCKET.

New Series Lamp and Socket

FOR ARC CIRCUITS.

SAWYER-MAN ELECTRIC CO.

510-534 West 23d Street,

SEND FOR CATALOGUE. NEW YORK.

GRIMSHAW AND

GRIMSHAW TRADE MARK WHITE CORE INSULATED WIRE

B. D. WIRES.

KENDALL & SLADE,

48 MILK STREET, BOSTON,

Electrical Supplies.

AGENTS FOR

New York Insulated Wire Company and Detroit Motor Company.

CONTRACTORS FOR ALL SYSTEMS OF ELECTRIC LIGHT WIRING.

ELECTRIC MOTORS FROM ONE-TWENTIETH H. P. UPWARDS.

We have just imported direct a large

STOCK OF MILLING CUTTER BLANKS

(Annealed), forged by WILLIAM JESSOP & SONS, Limited, of their

Best Cast Tool Steel.

Sizes, - - - - - 4 inches diameter, 5-8 inches thick,
To - - - - - 6 " " 2 1-4 " "
Varying by 1-4 inch in diameter and face.

Price, 25 CENTS per lb.

THE GARVIN MACHINE CO.

Laight and Canal Streets, New York.

CLIMAX TAPE!

SHALL WE SEND YOU A SAMPLE?

Write the BOSTON RUBBER SHOE COMPANY, Boston, Mass.

GENUINE INGOTS & MANUFACTURES BEAR OUR RED TRADE MARKS

Phosphor Bronze

PHOSPHOR-BRONZE

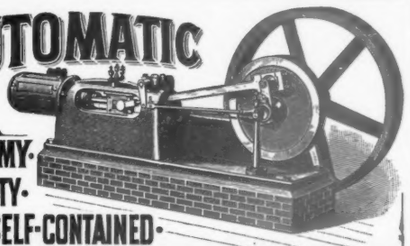
INGOTS, CASTINGS & MANUFACTURES.

THE PHOSPHOR BRONZE SMELTING CO. LIMITED

512 ARCH ST. PHILADELPHIA PA. U.S.A.

ORIGINAL MANUFACTURERS OF PHOSPHOR-BRONZE IN THE UNITED STATES AND OWNERS OF THE U.S. PATENTS.

THE PRICE AUTOMATIC

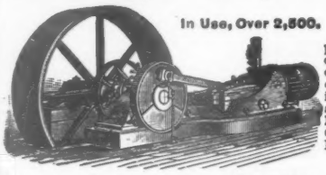


GUARANTEED ECONOMY · REGULATION · DURABILITY · SIMPLICITY · SELF-CONTAINED ·

8 TO 300 H.P. PAIR & TANDEM · COMPOUNDS · THE JOHN T. NOYE MFG CO. BUFFALO, N.Y.

FAIRBANKS, MORSE & CO., Western Representatives, Chicago, St. Louis, Kansas City, Omaha, Denver, St. Paul
ALBERT FISHER, 89 Liberty Street, New York, Eastern Agent.

New Tangye Buckeye Automatic Cut-off Engines.



In Use, Over 2,500.

25 to 1,000 H. P.

These engines are the combined result of long experience with automatic cut-off regulation, and most careful revision of all details. They are designed and constructed for heavy and continuous duty at medium or high rotative speeds. Highest attainable Economy in Steam Consumption and Superior regulation guaranteed. Self-contained Automatic Cut-off Engines 12 to 200 H. P. for driving Dynamo Machines a Specialty. Illustrated Circulars, with various data as to practical Steam Engine Construction and performance, free by mail.

Address BUCKEYE ENGINE CO., Salem, Ohio.

SALES AGENTS:
W. L. SIMPSON, 10 Telephone Building, 18 Cortlandt Street, N. Y.
H. W. ROBINSON, 154 Washington St., Chicago, Ill. Robinson & Cary Company, St. Paul, Minn

THE WALKER ELECTRIC CO.,

MANUFACTURERS OF THE

WALKER ELECTRIC METER,

THE ONLY RELIABLE METER IN THE MARKET,

50 BROADWAY,

EDWIN SCOTT, President,
GEO. W. WALKER, Vice-Prest. & Gen'l Manager,
LEWIS G. TEWKSBURY, Sec'y and Treas. NEW YORK, U. S. A

POND ENGINEERING CO.,

ENGINEERS AND CONTRACTORS.

Complete Steam Plants for Electric Light and Power.

Engines, Boilers, Furnaces, Grates, Heaters, Pumps, Injectors, Pipe Work, Belting, etc., designed with special reference to the HIGHEST EFFICIENCY.

Our Extended Experience Enables us to Guarantee Satisfaction. Send for New Illustrated Pamphlet.

ST. LOUIS, CHICAGO, KANSAS CITY, OMAHA, DALLAS AND SEATTLE.

CHARLES R. VINCENT & CO.,

15 CORTLANDT STREET, NEW YORK,

Ball High Speed Automatic Cut-off Engines

MANNING VERTICAL TUBULAR BOILERS,

Complete Steam Plants Furnished and Erected.

WILLIAMS & POTTER,

15 CORTLANDT ST., NEW YORK.

Engineers & Contractors,

GENERAL AGENTS,

STRAIGHT LINE ENGINES

NEW ENGLAND BUTT CO.,

PROVIDENCE, R. I., U.S. A.,

MANUFACTURERS OF

BRAIDING MACHINERY

FOR COVERING

TELEGRAPH,

TELEPHONE

AND

Electric Light Wire,

LARGE SINGLE AND DOUBLE

BRAIDERS

FOR COVERING CABLES,

Single, Double and Triple

WINDERS,

Horizontal and Upright

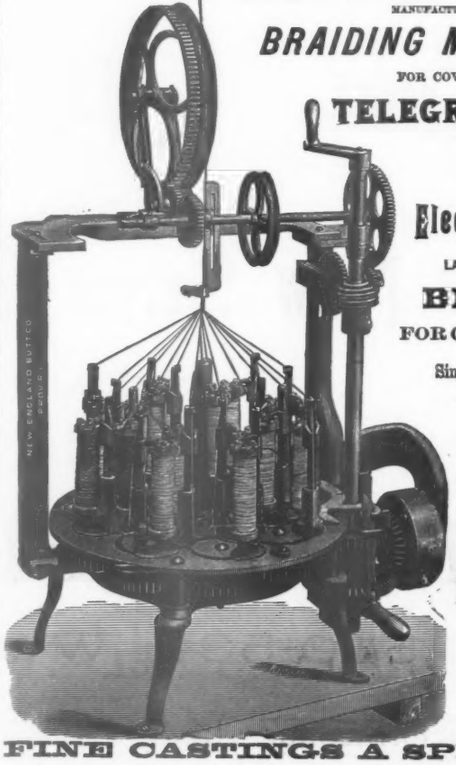
Taping Machines,

Cabling Machines,

Measuring Machines,

Stranding Machines,

Etc., Etc.

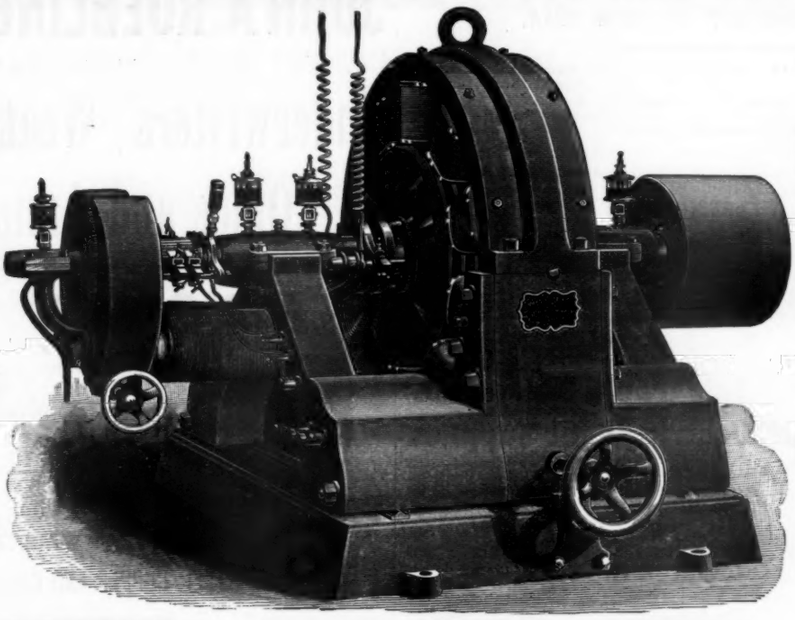


FINE CASTINGS A SPECIALTY.

THE NATIONAL TRANSFORMER SYSTEM
OF INCANDESCENT LIGHTING.

COMPLETE
Central ✳ Station
EQUIPMENTS
FOR
Light or Power
DISTRIBUTION.

COMPLETE
DIRECT CURRENT
SYSTEM
FOR
Isolated Lighting.



OUR APPARATUS
IS OF THE
Highest Effeciency,
MECHANICALLY AND ELECTRICALLY.
We guarantee its operation
AND
Protect our Customers.

We are Prepared to Undertake the
CONSTRUCTION
OF
Electrical ✳ Plants
Of Whatever Magnitude.
CORRESPONDENCE SOLICITED.

NATIONAL ELECTRIC MFG. CO.
Eau Claire, Wis.
GEO. B. SHAW, - - - - - GEN'L MANAGER.

BAKER, BALCH & CO., Gen'l Agts., - - - - - - Seattle, Washington.
THOMAS WOLFE, Southwestern Agt., - - Union Depot Hotel, Kansas City, Mo.
LITTLE, McDONALD & CO., Gen'l Agts., - 141 East Seneca St., Buffalo, N. Y.
METCALF, REED & CO., Western Agts., - - 1517 Larimer St., Denver, Col.
CHAS. M. BLANCHARD, Agent, - - - - - Girard Building, Philadelphia, Pa.
L. N. COX, Agent, - - - - - - 16 Fifth St., S. E., Washington, D. C.
W. N. GRAY, Special Agt., - - Room 12, Chamber of Commerce, Cincinnati, O.
PITTSBURGH ELECTRIC CO., Special Agts., - - 531 Wood St., Pittsburgh, Pa.
NATIONAL ELECTRIC MFG. & CONSTRUCTION CO., - - - - - - - - - - Tower Building, No. 50 Broadway, New York City.
NATIONAL ELECTRIC DEVELOPMENT CO., - - - - - - - - - - - - - History Building, 723 Market St., San Francisco, Cal.
SIMPSON-DAVIS ELECTRICAL CONSTRUCTION CO., Agents, - - - - - - - - Winnipeg, Manitoba.
A. IRVINE, Agent, - - - - - - - - - - - - - - - - - - Emelie Building, St. Louis, Mo.

THE NEW
EDISON-LALANDE BATTERY.

MANUFACTURED UNDER AUTHORITY OF
THOMAS A. EDISON.

Primary Batteries for Telegraph "Mains" and "Locals," Electro-Motors, Electro-Plating, Telephone Transmitters, Electro-Medical Instruments, Annunciators and Burglar Alarms, and all Classes of Closed and Open Circuit Work.

FURTHER PARTICULARS AND INFORMATION FURNISHED UPON APPLICATION.

ADDRESS:
EDISON MANUFACTURING COMPANY,
JAMES F. KELLY, General Sales Agent,
19 Dey Street, New York.

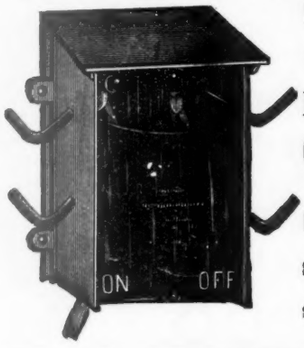
HAZAZER & STANLEY,
ELECTRICAL HOUSE FURNISHINGS,
32 and 34 FRANKFORT ST., NEW YORK.

T. W. NESS, Montreal, - - - - - - - - Agent for Canada.
A. SECHRIST & CO., Denver, - - - - - - Agent for Colorado.
LOUIS B. HETTY, 126 Eddy Street, San Francisco, Cal., Agent for Pacific Coast.

MESSRS. HAZAZER & STANLEY, NEW YORK, July 25th, 1890.

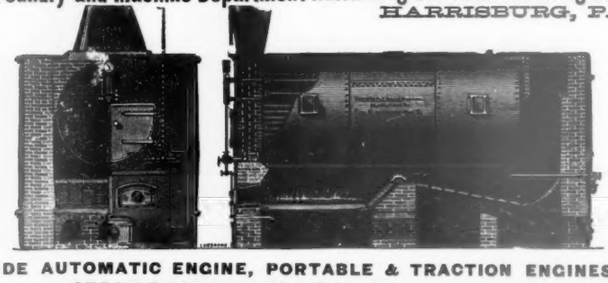
GENTLEMEN: Please ship immediately the 100 bells ordered last week. I have used your bells for the last five years and have found no other equal to them. They are the best electric bells on EARTH.

Yours truly,
CHAS. E. GOODRICH, Electrician,
503 Eighth Avenue.

THE E. S. GREELEY & CO.,


Nos. 5 & 7 Dey St., New York
Manufacturers and Importers of and Dealers in
Telegraph, Telephone
— AND —
Electric Light Supplies
AGENTS FOR
Cleveland Arc Light Cut Outs & Gang Switches
Cleats, Rosettes, Moulding, Pins, Cross-Arms, Brackets. Insulating Tapes.
Rubber, Porcelain and Glass Insulators
WIRES OF ALL KINDS.
Silk & Cotton Covered Flexible Conducting Cord of various sizes for Incandescent Lighting.
Spikes, Pole Steps, Lag Screws, Drive Screws, Turn Buckles, Etc.

Weitmyer Patent Furnace,
MANUFACTURED AND SOLD BY
Foundry and Machine Department Harrisburg Car Manufacturing Co.
HARRISBURG, PA.



I DE AUTOMATIC ENGINE, PORTABLE & TRACTION ENGINES.
STEAM ROAD ROLLERS, BOILERS OF ALL DESCRIPTIONS.
New York Office, Messrs. Fleming & Kimball, 17 Dey Street.
New England Office, Messrs. John Post, Jr. & Co., 70 Kilby St., Boston.
Baltimore Office, Messrs. Thomas K. Carey & Bro., 26 Light St., Balt.
WESTERN OFFICE. MESSRS. ENGLISH. MORSE & CO., KANSAS CITY, MO.

ELECTRIC CONDENSER
WM. MARSHALL, MANUFACTURER.
Standards a Specialty
Rooms 2 and 4, University Building, New York.

SUBSCRIBE FOR THE ELECTRICAL REVIEW. NOW

WELLINGTON
Belt Holder
The simplest, cheapest and handiest device in existence for shifting Dynamo Belts. Please write for circulars to
W. R. SANTLEY & CO.
WELLINGTON, O.

The Only Watches for Electricians.
FOR SALE BY ALL JEWELERS.
Paillard Non-Magnetic Watch Co.,
192 BROADWAY, NEW YORK.

INTRODUCING ENTIRELY NEW PRINCIPLES.

Pat. Mar. 19, 1889. THE OLD STYLE.
THE ACME LINK BELT
IS MADE ONLY BY THE
Page Belting Company, Concord, N. H.
BRANCHES: Boston, New York, Chicago, San Francisco. Also, manufacturers of all the staple grades of Leather Belting and Lacing. Send for Illustrated Catalogue—a valuable treatise on belting, Free.

JOHN A. ROEBLING'S SONS CO.
MANUFACTURERS OF
Underwriters', Weather-proof, Office and Annunciator Wire.

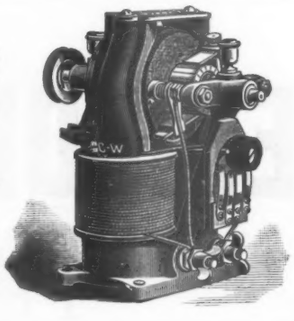
MAGNET WIRE
AND ALL OTHER KINDS OF
Insulated Electric Wires and Cables.

Hard Drawn and Soft Bare Copper Wire. Galvanized Telegraph Wire.
PLAIN AND GALVANIZED WIRE OF EVERY DESCRIPTION.
IRON, STEEL, COPPER AND GALVANIZED WIRE ROPE.

SEND FOR CATALOGUE AND PRICES.

JOHN A. ROEBLING'S SONS CO.,
NEW YORK OFFICE AND WAREHOUSE, 117 & 119 LIBERTY STREET
H. L. SHIPPY, Secretary.
WORKS: - - TRENTON, N. J.

THE
Crocker-Wheeler
PERFECTED MOTORS
Develop Full Power at Half the Speed of other Makes and are, Therefore, Noiseless.
WORKS:
14th, Washington and 13th Streets,
NEW YORK.



DEPARTMENT OF ENGRAVING,
ELECTRICAL REVIEW,
13 PARK ROW NEW YORK.
ELECTRICAL ENGRAVING, A SPECIALTY.
SEND FOR ESTIMATES OF CATALOGUE & ELECTRICAL *ENGRAVING, OF EVERY DESCRIPTION.*

THE NATIONAL CARBON CO
CLEVELAND, OHIO.
MANUFACTURERS OF
ELECTRIC LIGHT CARBONS AND BATTERY MATERIAL.

CENTRAL · ELECTRIC · COMPANY,

116 & 118 Franklin Street, Chicago.

CONNECTED BY PRIVATE WIRE WITH POSTAL TELEGRAPH CABLE CO.

OKONITE
TRADE MARK.

General Western Agents for Okonite and Candee Wires.

THE CENTRAL SPARK ARRESTER.

This device prevents the dropping of sparks from arc lamps. It also keeps flies and other insects from getting into the globe.

THE PERRY WIRE PEELER.

This handy little tool is becoming very popular with bell-hangers and incandescent wire men.

THE HOT WIRE LIGHTNING ARRESTER.

No magnet or self-induction. Furnishes absolute protection and is automatic in its action. Our price on these instruments is very low.

ANTI-MAGNETIC WATCHES.

We have completed arrangements with the Electricians' Time Company, by which we are enabled to offer to electrical men a thoroughly first-class watch, absolutely protected from magnetic influence and at a very low price. Each watch is accompanied by a guarantee, stating just what it is, and in cases where desired, payments are made easy. Send for a descriptive circular.

WE ALSO CARRY A FULL LINE OF

K. W. PORCELAIN CUT-OUTS. STODDARD PORCELAIN CUT-OUTS. CLEVELAND SWITCHES.
PAISTE SWITCHES. BRANCH BLOCKS, and all kinds of Electrical Supplies.

CENTRAL ELECTRIC COMPANY,

116 & 118 Franklin Street, Chicago.

UNITED ELECTRIC TRACTION COMPANY,

EXECUTIVE OFFICES, 115 BROADWAY, NEW YORK.

AGENCIES:

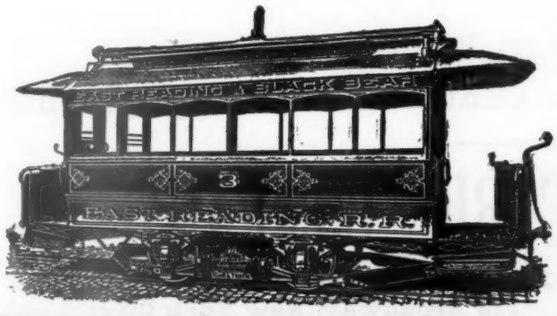
926 Drexel Building, Philadelphia. 111 Water Street, Pittsburgh, Pa. 456 Rookery Building, Chicago.

Electric Railways and Power Stations,

STATIONARY MOTORS, STORAGE BATTERIES.

DYNAMOS, 1 to 250 H. P. MOTORS, ½ to 100 H. P.

WORKS, JERSEY CITY, N. J.



JOHN STEPHENSON COMPANY

LIMITED,

NEW YORK.

Street Cars

FOR

Electric Motors.

BOOKS ON ELECTRICAL SUBJECTS
Will be mailed to any address, postage prepaid, on receipt of price. Address,
ELECTRICAL REVIEW PUB. COMPANY.
13 Park Row, New York. P. O. Box, 3,329.

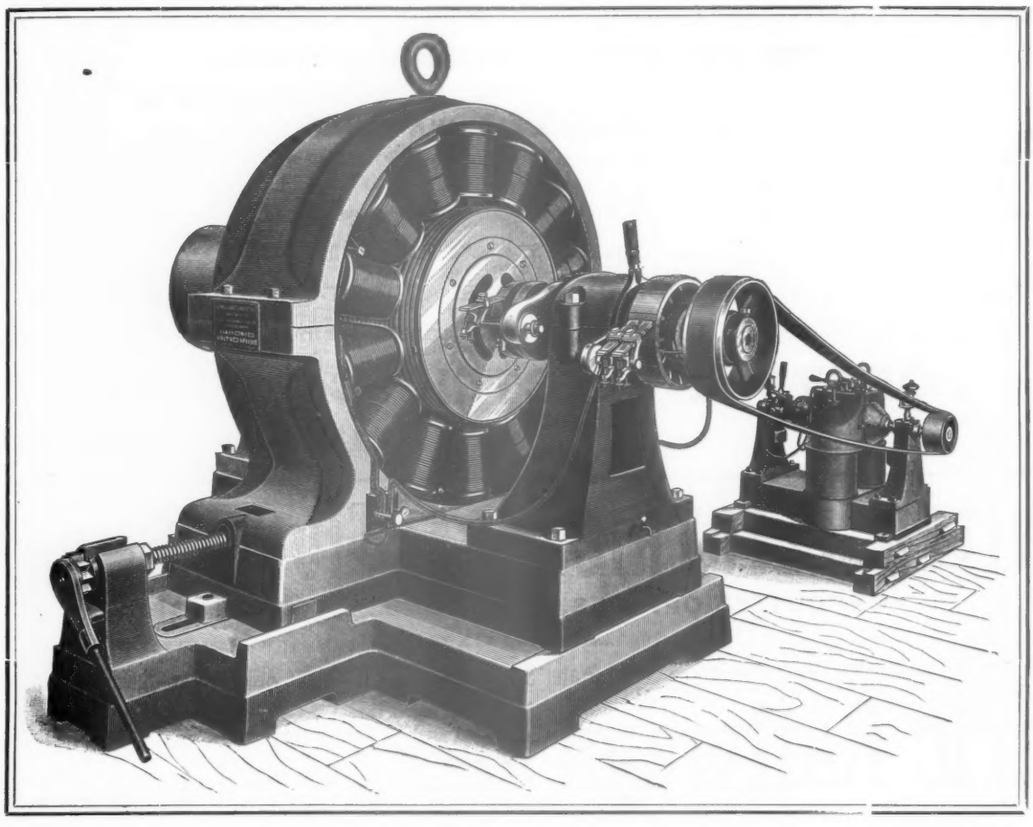
WRITE For the Electrical Review's *New Catalogue* of all Electrical and Scientific Books.
18 PARK ROW, NEW YORK.

IN BUYING THE BEST YOU BUY THE CHEAPEST.

The Thomson-Houston Alternating System

IS THE BEST.

It has proved its merits in actual operation, and they have been fully substantiated by orders for additional equipment from a majority of its users.



IMPROVED DYNAMOS,

Unequaled in Mechanical Design and Construction,
Self-Regulation and Economy of Operation.

Transformers of the Highest Efficiency.
Superior Incandescent Lamps and Electric Meters.
Complete Central Station Equipments.

THOMSON-HOUSTON ELECTRIC COMPANY,

620 Atlantic Avenue, Boston, Mass.
Wall and Loyd Streets, Atlanta, Ga.
1110 Noble Street, Philadelphia, Pa.
215 West Fourth Street, Cincinnati, O.
503 Delaware Street, Kansas City, Mo.
148 Michigan Avenue, Chicago, Ill.
115 Broadway, New York City.
15 First Street, San Francisco, Cal.
403 & 405 Sibley Street, St. Paul, Minn.
1333 F Street, Washington, D. C.